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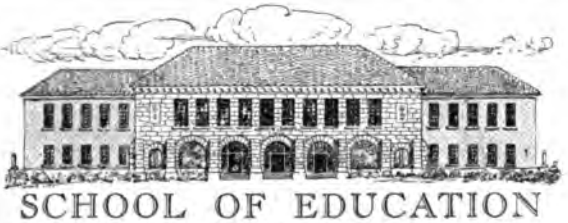
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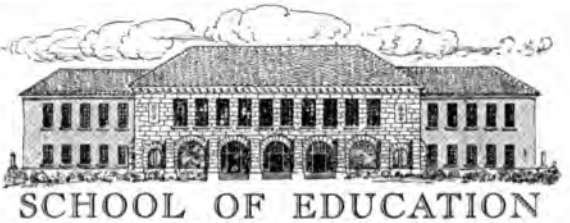

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A MEASURING SCALE FOR FREE-HAND DRAWING
PART I.—REPRESENTATION

A MEASURING SCALE FOR FREE-HAND DRAWING
PART I.—REPRESENTATION

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I. INTRODUCTION: COLLECTING MATERIAL

The scale is intended to measure three general phases of free-hand drawing: Representation, Design and Composition and Color. The themes of each phase from which sample drawings were made were chosen with a view of exemplifying the primary principles of drawing. In using the scale, the attention of both teacher and pupil is directed to the elements of drawing as revealed by the samples in steps of achievement on the scale, and to the more or less analytic descriptions given under each sample. Obviously, then, the scale is essentially analytic in both construction and function. The purpose is to measure drawing as done in public elementary and high schools, to measure the pupils' progress in that subject year by year or grade by grade. The numerical values of the scale units represent values above a sample rated as zero. The relation of grade achievement to these values will be determined as the scale is standardized.

1. From Primary, Grammar and High School Grades

As a rule, the use to which the sample drawings were to be put was explained to the supervisor of drawing in a personal interview. Circular letters describing the purpose of the work, listing the themes for the drawings, and giving details of the conditions under which they were to be prepared were given to the supervisor who distributed them among teachers of drawing. These letters were of three slightly different sorts, depending on whether they were to be used by teachers of lower school grades (first, second, third, and fourth) or by teachers of higher elementary grades (fifth, sixth, seventh and eighth), or by high school teachers. They were sent out in October and November, 1919, under the auspices of the Department of Education of

The Johns Hopkins University. Sample copies of the letters are here given.

To Teachers of Drawing in the Lower Elementary School Grades:

The drawings asked for below are to be used in the construction of a measuring scale for estimating the pupil's rate of progress in drawing.

Three phases of drawing are to be done: 'Representation,' 'Design and Composition,' and 'Color.' The themes from which the drawings are to be made are numbered; four in 'Representation,' four in 'Design and Composition' and four in 'Color.'

Part I. Representation

1. Draw a house. 2. Draw a rabbit. 3. Draw a figure in action (boy running). 4. Make a brush drawing of a tree.

Part II. Design and Composition

1. Illustrate a story. Any story which the teacher may select such as The Pied Piper blowing his horn with children or rats following, The Three Bears, Cinderella, one of Aesop's fables, Aladdin and the Wonderful Lamp, etc., will be acceptable for this exercise. It may be done with colored crayons or scissors and paper.

2. Make a border approximately 2″ x 6″. A tree, a rabbit or other animal, a boat or a house are suggested as units, but any form with which the children are very familiar may be used. It may be done with paper and scissors or with crayons. In the kindergarten and Grade I it may be connected units secured through manner of folding the paper, such as paper dolls taking hold of hands, boats, trees, etc.

3. Make a poster advertising a school activity. In the kindergarten and Grade I, if children are unable to form words, they may make the poster omitting the lettering. The work will and should be crude but it should represent the child's expression of some event within his experience. It may be the announcement of a game, entertainment, or other school activity, a garden poster, or a poster to stimulate thrift, but should, above all, have the child's interest.

4. Draw or cut out of paper a pattern for a bowl or other utensil which you would like to model out of clay. Draw upon it a simple decoration which you think will make it more attractive. This is not to be a drawing in perspective. Make top and bottom lines straight.

Part III. Color

1. Draw from memory the United States flag on 9″ x 12″ drawing paper. Use colored crayons and make the colors as near like the real flag as possible.

2. Paint a flower in color. Use brush and water colors if you have them. If not, draw the flower with colored crayons. This is to be done from memory. (Choose a flower having a decided color—a single flower preferred.)

3. Make a color circle or wheel showing the six standard colors and write the first letter of each color above the circle.

4. Make a border approximately 2″ x 6″ using complementary colors. If available, use colored papers. If not, use colored crayons.

Note.—Kindergarten teachers may do the first two only.

Please have all pupils make from memory one drawing each of Numbers 1, 2, 3 and 4, in each of the three phases indicated above.

Have the pupil write on the back of the drawing paper his age and number of the school grade, but nothing more. No writing of any kind should appear on the page with the drawing. The teacher in charge will record on the back of the drawing the approximate time in minutes required to make it.

As far as possible, have the drawings made under class room conditions.

It is assumed that the drawing paper and other materials will be uniform in quality for all the pupils.

The pupil should understand clearly *what* is to be drawn, but no instruction should be given as to *how* it should be done.

(It is understood that pupils of the kindergarten and of the first grade will attempt only those themes which they understand and of which they have memories, e. g., a house, a boy running, etc.)

To Teachers of Drawing in the Higher Elementary School Grades:

The drawings asked for below are to be used in the construction of a measuring scale for estimating the pupil's rate of progress in drawing.

Three phases of drawing are to be done: 'Representation,' 'Design and Composition' and 'Color.' The themes from which the drawings are to be made are numbered; four in 'Representation,' four in 'Design and Composition' and four in 'Color.'

Part I. Representation

1. Draw a house. 2. Draw a rabbit. 3. Draw a figure in action (boy running). 4. Make a brush drawing of a tree.

Part II. Design and Composition

1. Illustrate a story in such a way as to show the use of the principle of subordination. Any well-known story from literature or history may be chosen. Such subjects as "The Pied Piper of Hamelin," "Hannibal Crossing the Alps," "Jason and the Golden Fleece," "Story of the Wooden Horse," "The Boston Tea Party," "The Courtship of Miles Standish," etc., furnish material from the other subjects in the curriculum.

2. Make a 2" x 6" border, illustrating the principles of repetition and rhythm, using any unit with which the children are familiar.

3. Make a poster advertising a school activity, composed of lettering and an illustration. Choose something simple which they know how to draw well, and combine it with as little lettering as possible to make it forceful.

(The above problems may be done with colored crayons, with scissors and paper, with drawing pencils, or with charcoal, but the drawings will be judged on the merits of Design and Composition only.)

4. Draw or cut out of paper a pattern for a bowl, vase, or other utensil which might be modelled out of clay. Draw upon it a simple decoration which will make it more attractive.

(This is not to be a drawing in perspective. Make lines representing the top and the bottom of the dish horizontal.)

(Use paper 9" x 12".)

To insure that all pupils work under uniform conditions, it is advised that the following principles of composition be explained to the class before beginning the exercise:

1. Subordination means the organization of elements about a center of interest and the elimination of unimportant details. The use of this principle brings order out of confusion, and gives unity to a design or composition.

2. Repetition in a design or composition means the use of the same element or elements again and again. The intervals may be equal, as in a repeating pattern or border, or unequal, as in a landscape.

3. When the spacing is done in an interesting way it produces rhythm.

Part III. Color

1. Make a color wheel showing twelve colors, including the six standard colors and six intermediate colors. Use water colors if possible. If not, available, use colored crayons. (These colors can be only approximately correct, but the exercise will test the pupil's ability to discriminate in the use of color.)

2. Make a poster using a color triad with black, or white, or both. Use colored papers, water colors, or crayons.

3. Make a decorative landscape, using three values of one hue and a complementary hue.

4. Make a border approximately 2" x 6", using two values of one color and its complement. The background will represent one of the values or one color, as desired. Use colored papers, crayons, or water colors.

To Teachers of Drawing in the High School (Grades 9, 10, 11 and 12):

(The instructions here are similar to those given above.)

The material for the several exercises follows:

Part I. Representation

1. Draw a house. 2. Draw a rabbit. 3. Draw a figure in action (boy running). 4. Make a brush drawing of a tree.

Part II. Design and Composition

1. Illustrate a story in such a way as to show the principle of subordination. Any well-known story from literature or history may be chosen. Use pencil, charcoal, or any medium desired, but the drawings will be rated upon the composition only.

2. Make a 2" x 6" border illustrating the principles of repetition and rhythm. Any medium may be used, but proportion or good spacing will determine the success of the exercise.

3. Make a poster advertising a school activity. It may be done in any medium, but the exercise will be judged on composition and design only. Technique of drawing or color will not enter into the rating of these posters. Use as little lettering as possible, and for the illustration choose something you can draw well.

4. Make a design for a sideboard showing front and end views. Proportion and spacing will be considered in judging this exercise. This is not an exercise in perspective. Do not try to show the top.

The above problems may be done with colored crayons, or scissors and paper, or with drawing pencils, but the drawing will be judged on the merits of design and composition only. Before beginning the

exercises, be sure that you understand the meaning of the principles involved. The following definitions will assist in this. They may be elaborated upon by the teacher in any way she may desire.

(Definitions of subordination, repetition and rhythm were included as above.)

PART III. COLOR

1. Make a poster using a color triad with gray, black, or white. The poster may be made of colored papers or show card colors.
2. Make a decorative landscape using three values of one hue and a complementary hue.
3. Make a 2" x 6" border showing an analogous harmony.
4. Make two scales, one showing six values of one color, and the other six intensities of the same color.

It will be observed that the circular letters required: (1) that the drawings be made under class room conditions as nearly as possible; (2) that they be made from memory and without instruction on the themes immediately preceding or during the drawing exercise; (3) that the time spent in making the drawings (passing and collecting material not included), the age and grade of the pupil, be stated on the back of the drawing. The teacher of art, as well as the general reader, is again reminded that the drawings were done from memory and without coaching for the particular exercise in question.

2. MATERIAL COLLECTED AND CATALOGUED

The first returns were received in December, 1919, from the city public schools of Baltimore. From that date until June, 1920, drawings were received from the city public schools of Washington, D. C., Duluth, Minn., Virginia, Minn. and from Oshkosh, Wis. Over 600 came from two private schools in Baltimore. The number of drawings on the 19 themes in this preliminary collection totalled over 14,000. We are concerned in this report, Part I, with the drawings of the first four themes, drawings that involve the technique of representation only. The number by grades and by themes are shown in Table I. While this number is perhaps sufficient, our experience is to the effect that both quality and variety of the samples would have been more satisfactory had they been gathered from a larger number of localities.

This defect, if it be one, will be corrected in collecting further samples for the remainder of the scale on (1) *design and composition* and (2) *color.*

TABLE I

SHOWING DISTRIBUTION OF DRAWINGS BY GRADES AND BY THEMES

	Grades													
Themes	Kdgn	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	XII	Tota
1. House	90	200	204	130	151	136	111	128	90	130	84	33		1487
2. Rabbit	71	137	171	113	88	66	73	109	56	90	22	20	6	1022
3. Figure in action.....	10	131	179	109	69	120	112	100	66	55	45	36		1032
4. Brush drawing of tree	66	173	286	175	175	178	175	180	122	51	44	48		1673
Totals	237	641	840	527	483	500	471	517	334	326	195	137	6	=5214

In the matter of constructing a scale by using a series of drawings of the same theme, Professor Thorndike says in his pioneer drawing scale that

> If we had in the scale a series of drawings of flowers of merit, 2.4, 3.9, 5.7, 6.5, 7.8, 8.6, 10.5, etc., a series of drawings of horses of merit, 2.4, 3.9, 5.7, 6.5, 7.8, 8.6, 10.5, etc., a series of designs for book-covers of merit, 2.4, 3.9, 5.7, 6.5, 7.8, 8.5, 10.5, etc., ... the scale would obviously be more useful to measure the merit of drawings of horses, book-covers, and flowers . . . . than it now is.

Teachers of drawing will readily understand the reasons for selecting these four themes: house, rabbit, figure in action, brush drawing of tree, for a scale in 'representation,' but that their purpose may be apparent to everyone some further comment is necessary.

Drawing merely to represent objects is not regarded as an end in itself; it is intended, rather, to accompany the work in design and composition and color. The use and treatment of a theme in representation in the teaching of art, then, depends upon the frequency and readiness with which it serves the ends of design and composition. The four themes in question were chosen largely upon that principle and are intended to be thus used by teachers of drawing. They afford suitable exercises for the acquisition of the more elementary forms of technique and for drill work that is so essential in acquiring a drawing "vocabulary." Drawing a house trains in the art of expressing forms and construction by the use of perspective; drawing a rabbit affords an exer-

cise for expressing action, growth and texture; drawing the human figure in action develops the art of expressing motion, action, growth and texture in living forms. The brush drawing of a tree, owing to the nature of the drawing material used and to the comparatively exacting technique, presents a number of new problems. Spreading color for artistic effects by means of a brush requires during the operation all the attention at the pupil's command. And for that reason, the factors of form, proportion, growth, texture, and light and dark must be duly considered before applying the brush. It is planned to present design and composition and color in Parts II and III, respectively, of the scale.

The drawings were catalogued by school grades, each grade being indicated by a capital letter. Each sample in a grade was given a serial number, and the themes were shown by digits placed as exponents on the sample's serial number, e. g., $B3^2$ signified sample Number 3 of First grade drawing, and, if in representation, the theme, rabbit. Then by indexing the books in which the drawings were listed, it was possible to locate a sample at an instant's notice.

II. METHODS FOR GROUPING THE SAMPLES

1. Status of the Judges

Ninety-two judges were engaged on this portion of the work—Part I. Of this number twenty-eight, or 30%, were teachers of art or supervisors of art in city public schools; forty-nine, or 54%, were teachers of academic subjects in public schools and colleges. Nine, or 19%, were art students, and 6% were educated laymen.

2. Step 1: Distribution of Samples Without and With Aid of Legend

A new scale in any of the common branches must henceforth justify its existence by functioning in the school room. Obviously, a scale for free-hand drawing must fulfill that requirement, must be of a sort that both pupils and teachers can readily *use* and be appreciably benefited by such use. This principle has controlled all matters bearing on the construction of the present scale and especially on the methods for selecting and scoring the samples.

It was early decided, as already observed, that the scale should be analytic, that the differences between the samples forming the scale should consist of differences in degrees of mastery of evident principles of drawing, that steps, so-called, in the scale should embody principles susceptible of simple description and at the same time exhibiting the probable order in which they are achieved by the learner.

The plan, here finally adopted, had its beginning in 1911, when one of the authors found it necessary to devise a method by which to score some 225 drawings. The material consisted of free-hand drawings of a rooster, made under three different conditions. The large number of specimens made the usual methods of rating, e. g., serial and alternate, impractical. An inspection of the drawings showed a wide range of achievements; some were so poorly done that the

intentions of the author were not revealed, other groups contained samples that represented a bird but left the species in doubt. Still other drawings represented a domestic fowl other than a chicken, etc. Working over the drawings in this fashion resulted in the formulation of a set of 'checks' by which the rating was eventually done. The 'checks,' with their arbitrary values follow:

1

A drawing that does not show the author's intention is rated..... 0

2

A drawing that represents a bird but leaves the species in doubt is rated 1

3

A drawing that represents a domestic fowl other than a chicken, as turkey, guinea hen, etc., is rated..... 2

4

A drawing that represents a hen or leaves the sex in doubt is rated 3

5

A drawing that represents a rooster, but is lacking in artistic form (wooden), is rated..... 4

6

A drawing that expresses fair proportions and qualities of life is rated 5-6

7

A drawing that shows skill in the use of line to express qualities of life and good form is rated..... 7-8

8

A drawing that shows good arrangement and skill in the use of line to express life and form is rated.....9-10

The value of such a crude set of 'checks' or legend is limited to the drawings of a special object; and, besides, only a few of the checks embody principles of art. The control that it afforded the judges, however, in rating the samples fully justified its use and suggested, at the time, the desirability of formulating a legend that would be uni-

versal in its application, and that would embody the essential principles of art knowledge. The sugestion was acted upon (Gertrude L. Carey) and resulted in the formulation of three legends: one for scoring drawings in representation, one for design and composition, and one for color. They embody the primary principles of the three phases of drawing arranged on a probable genetic and development basis, or roughly, in the order in which they are acquired by the pupil. Only the legend on representation is given in this report. Its present form is the result of several revisions made in the light of years of experience in teaching and in directing art education in city public schools.

A. WITH AID OF UNWEIGHTED LEGEND

(Sixteen Judges Were Asked to Make the Preliminary Distribution)

Two of the judges were art supervisors, one an art teacher, two were art students, one an art connoisseur, and ten were regular teachers of academic subjects. The numerical values assigned to the principles grew apace with rough and tentative distributions of the drawings. When guided by the legend (unweighted), the judges experienced but slight difficulty in distributing a thousand or more samples into seven piles, and had considerable confidence with the majority of the classifications. Of course, they were often confronted with samples showing one or more drawing principles applied with some excellence, but markedly deficient in some other; and likewise, samples appeared on the borderland between two sets of consecutive principles.

These rough distributions piled the drawings from any school year high at the simpler end of the legend and thinned them out at the approach of the difficult end. The drawings in the large piles answering to the simpler principles showed wide differences in quality, while those of the better types, embodying higher principles of the legend, increased in similarity, and as a consequence, grades of difference grew markedly less. The drawings of the four themes followed the same principle.

B. WITHOUT AID OF LEGEND

It seemed desirable at this point to distribute the drawings, without the aid of the legend, into as many groups as qualitative differences could be discriminated. Four judges worked under these conditions. Two were graduate students in The Johns Hopkins University. One of these, who had formerly supervised drawing in the public schools, made 14 groups out of the houses—1487 drawings. The second student, who had taken general art courses distributed the rabbits—878, into 16 groups. A third judge, employed in an art store, an art connoisseur, distributed the 'figure in action' into 16 groups. The fourth judge, the writer, having a more intimate knowledge of the legend, was doubtless influenced thereby, made 18 groups of the rabbits, now to the number of 1022. The judges uniformly claimed that the capacity for discrimination improved decidedly with practice and believed that further practice would have increased the number of groups. These two lines of experience, (1) distributing the drawings under the control of the legend unweighted, and (2) distributing them without such control, and, in addition, the large number of samples to be handled, suggested that methods be devised whereby thousands of unsuitable drawings for scale making could be eliminated *under control,* and a few dozen fit samples be retained.

3. STEP 2: DISTRIBUTION OF SAMPLES WITH WEIGHTED LEGEND FOR PURPOSES OF ELIMINATING AND SELECTING DRAWINGS

The preliminary work thus far suggested that rejecting and retaining samples could be accomplished by applying, throughout the distribution, the question: "Does the sample *possess* or *lack* this or that principle of the legend?" While this method made it possible to distribute the drawings under control into seven groups, it made no provision for rating the drawings within a group, drawings that showed wide varia-

tions of skill in handling the *same principle* or set of principles.

Observations on the progress of pupils' drawings from year to year (Gertrude L. Carey) has shown that more steps of marked improvement occur, as a rule, in the earlier years, and that the increments of improvement in the use of a given principle diminish gradually as maximum skill is attained. The same principle, of course, operates in the acquisition of any skillful art. For these reasons, it was decided to attach unequal weights to the drawing principles, weights of wide range at the lower end, and gradually narrowing toward the other. Henceforth, these numerical weights are referred to as *Group Scores*. There are six, not including the zero group. The fact that from 14 to 18 steps could be discriminated in these drawings and that the scoring process improved with practice, suggested that at least 20 steps of equal intervals should be provided and duly apportioned to the *score groups*. The number of equal steps (class intervals) assigned to a group score was based upon the number of differences sufficiently marked and characteristic, so as to permit description in untechnical language. By this method it was discovered that six steps could be made out in group score 2, the one above zero, that five steps existed in group score 3, and four steps in group score 4, and two each in group scores 5 and 6, respectively, and one step in group score 7.

The steps within a score group were raised to five units (the width of step or class interval) to avoid the suggestion of scoring to a mere point, and, besides, it expanded the range of the score groups from 0 to 100, which will likely prove convenient in the matter of standardization. Subsequent rating of samples showed, however, that they were rarely scored above the interval of 91-95, and thus the range from 0 to 100 proved entirely adequate for distributing the qualities of drawings now done in the public schools. The legend in its final form appears on page 14.

Drawings of the ZERO TYPE marked the starting point. To determine the next sample for the next step in the scale, the more usual method calls for one which 75% of the judges consider just better than zero; a third sample is one having the same percentage of agreement that it is just better than the *second* sample; and the fourth, fifth, etc., samples of the corresponding steps of the scale are similarly arrived at. We rejected this method for these reasons: (1) The desirability of securing a scale in terms of special values ranging from 0 to 100. (2) A drawing scale to function must embody principles and technique of drawing arranged on a progressive plan. Principles expressed in the samples of the scale must be chosen just as they are combined and applied by the pupil under conditions of learning; and the difference between successive steps should be sufficiently concrete so as to be recognized by the pupil, especially when described in simple language.

A sample, to be just better than zero in the present study, must have meaning as conditioned by the theme, but it must not possess principles of art as such. According to the legend, the sample must be "deficient in the elements of proportion, etc." The term 'deficient,' rather than 'lacking,' was preferred on the grounds that a drawing entirely void of proportion, etc., would also lack meaning. The legend provided for six degrees of meaning, for the reasons assigned above. A sample, to be placed just beyond the mere "meaning" group, must express an intentional use of an elemental art principle, e. g., proportion, balance, structure. Here five steps were formed. The principle governing the formation of the rest of the score groups may be made out from the legend.

LEGEND FOR SCORING DRAWINGS IN REPRESENTATION

Distinguishing principles of the groups	Group score	Score intervals
1		
A drawing that fails to express the intentional meaning of the pupil may be rated.....	0	0
2		
A drawing that expresses the intentional meaning of the pupil, but is deficient in the elements of proportion, structure, and action, may be scored from	1 to 30	1- 5 6-10 11-15 16-20 21-25 26-30
3		
A drawing that expresses action and the elements of proportion and structure may be scored from	31 to 55	31-35 36-40 41-45 46-50 51-55
4		
A drawing that expresses action and the elements of proportion, structure, relation of parts and perspective, but has a minimum of artistic qualities, such as growth, texture, and structure in living and constructed forms, may be scored from.....	56 to 75	56-60 61-65 66-70 71-75
5		
A drawing that expresses proportion, a knowledge of the fundamental principles of perspective, action in living forms, and some skill in the use of line and dark and light to show growth, texture and structure, may be rated from	76 to 85	76-80 81-85
6		
A drawing that shows proportion, a knowledge of perspective, of structural features, and of action and a more skillful use of line and dark and light to show growth, texture and structure in living and constructed forms, may be rated from.....	86 to 95	86-90 91-95
7		
A drawing that shows correct proportions and an understanding of the principles of perspective, of structural features and action, and considerable skill and feeling in the use of line and dark and light to show growth and texture may be rated from.....	96 to 100	

The photograph shows distribution under control of legend and of the 'type' drawing. Conceive the lower picture to be moved so that its left end adjoins the right end of the upper: thus arranging the score intervals in a continuous series, 0 to 96-100, from right to left. The small cards in middle row bear the score interval; the pile below contains samples judged equal in value to the score interval and the sample directly above is the 'type' of this score.

A copy of the directions for using the legend and for scoring the drawings was placed in the hands of the judges. The directions follow here.

DIRECTIONS TO THE JUDGES FOR SCORING THE DRAWINGS

You are asked to score in numerical terms drawings made to represent objects.

I

Read carefully the legend prepared to assist you in rating the drawings. It contains the primary principles of drawing arranged in the order in which they are usually mastered. You will note that the drawings may fall roughly into seven groups according as they possess, or lack, these principles, and into twenty-one groups according to the degree of skill shown in applying the principles.

II

To score a sample:

1. Observe what principles it embodies, e. g., look for (a) intentional meaning; (b) proportion and symmetry in parts, between parts, as a whole; (3) elements of perspective, growth, texture, and structure in living or in constructed forms, as shown by light and dark, and by line, etc.

2. Observe the degree of skill with which the principles have been handled.

3. From (1) and (2) determine the numerical score of the sample. Then place the drawing or sample on the score-table by the label bearing its score.

III

Labels have been provided for scores ranging from 0 to 100. If this range proves inadequate, make additional piles beyond the 96-100 limit: notice that each of the 20 intervals above 0 are divided into points. Make as many trials as you like until you are satisfied with the score assigned the specimen. Select a 'type' drawing for every pile that you make which expresses the principles of that score. Place the 'type' conspicuously by the side of its assigned score (label) so that it may aid in scoring other drawings.

IV

After having scored and placed all the drawings of a theme into the several score piles, arrange each pile, including its type, in a serial order, beginning with the poorest and ending with the best; in this case only one drawing can be assigned to a given position.

All scoring is to be strictly individual. Do not examine the back of the drawings.

4. USE OF "TYPE" DRAWINGS FOR CONTROLLING JUDGMENTS

In the preliminary distribution without the legend it was found that the last or top drawing of a group exerted an undue influence in scoring subsequent and somewhat similar samples. No marked errors occurred so long as the last

scored sample fell within the dominant features of the group. But it would happen that an irrelevant feature or an exaggerated accessory, e. g., an unusually good fire engine, or a house on fire in the drawings of the 'Figure in Action,' would appear in a sample and tend to detract attention from the essential features that should have prevailed in the distribution of the samples. To prevent errors arising from such a source, the judges were instructed in the 'directions' (see above) to select a representative or 'type' drawing for a score group as it was being formed and to place it conspicuously beside or in front of the score group. The drawings in front of the score groups in the accompanying photograph were the 'types' selected by a judge while scoring the brush drawing of a tree. The 'type' could be changed if a more representative one appeared. The judges were uniform in affirming that these 'types' stabilized their judgments.

As soon as a judge had completed a distribution of all drawings of a theme, the median sample for each pile of the 'score intervals' was found by arranging all drawings of the interval in a serial order from the poorest to the best. (See instruction to judges.)

5. Results from Preliminary Distributions

Since every sample was registered in ledger-fashion, it was possible to post its scores on the same line. A portion of such page appears here as a sample.

J 21^{s} (15) 61–65; 71–75; 61–65; 66–70; 56–60.
J 22^{s} (15) 76–80; 61–65; 66–70; 46–50.
J 23^{s} (13) 66–70; 61–65; 71–75; 66–70.
J 26^{s} (13) 46–50; 56–60; 56–60; 31–35.
J 27^{s} (14) 76–80; 76–80; 86–90; 61–65.
J 28^{s} (16) 81–85; 81–85; 91–95; 81–85. (checked.)

'J' means that these drawings were done by pupils of 9th grade, '3' means that they were 'figures in action,' number in parenthesis shows pupil's age, and the numbers to the right are the scores assigned by four different judges; specimen J 21^{s} was scored by five judges.

Those samples receiving the same score by three of the four judges or by four of the five judges, or the same score by all of the judges were checked as possible specimens for the scale.

The drawings of 'house' were thus distributed by five judges, those of 'rabbit' by five, and 'figure in action' and 'brush drawing of a tree' by four judges each. Table IIa shows the results of a single distribution by one judge. Eighteen similar tables were constructed for as many complete distributions. Tables IIb, tree, and IIc, house, are the combinations of two and five tables, respectively, of single distributions. Eighteen similar tables are on file for every complete distribution.

A casual study of the tables show that the drawings of the first four years are largely scored within the first quarter range, 0-25, of the weighted legend, that the fifth, sixth, and seventh years are scored within the first and second quarter ranges, 0.45, and that the eighth, ninth, tenth, and eleventh are scored, for the most part, in the third quarter range, 50-75. Out of 680 houses done by the four higher grades (8, 9, 10, and 11) not quite seven per cent were scored in the fourth range, 76-100.

The drawings of grades five, six and seven were distributed with marked frequency throughout the range of the legend, and especially the drawings of the 'tree' and of the 'figure in action.'

The column headed 'Grade of Mode' shows the school year that contributed the most drawings to the score-step shown in the column to right of 'total'; e. g., in Table IIc, c means that the second grade contributed the most samples to step 26-30. The column headed 'Type' contains the symbols of drawings chosen by the judges as the most representative drawings in the respective score groups; e. g., in Table IIc, $K48^{1}$ means that the drawing bearing that symbol and done in the 10th school year was chosen to represent the score value of 51-55. The column headed 'Median sample' registers drawings that fell in the median position when all

TABLE IIa

RESULTS OF RATING PUBLIC SCHOOL DRAWINGS DONE FROM MEMORY BY ALL GRADES

Number of School Grades K, I, II, III, IV, V, VI, VII, VIII, IX, X, XI, XII

NAME OF JUDGE: MISS S———. NAME OF THEME: FIGURE IN ACTION

Symbols for Grades	A	B	C	D	E	F	G	H	I	J	K	L	M	Total	Grade or Mode	Type	4 Samples below Medians	Median	4 Samples above medians.
Score Intervals.	0.0	9.22	14.08	16.80	18.09	24.32	38.49	53.68	74.50	84.99	91.61	96.99							
0	6	18	7		1	1	1							34	B	A5			
1 – 5	3	32	22	13	2	3	2	4						81	B	B60	C17, B15, B19, B2	B64	B49, B103, C12, B66.
6 – 10	1	24	32	11	10	8	4	3	1					94	C	B20		D18	
11 – 15		21	46	27	11	14	4	8	0					131	C	D48		C164	
16 – 20		29	59	20	19	22	15	8	6					177	C	C96	contained	G25	contained
21 – 25		5	7	19	12	18	8	11	4					84	D	F244	samples of	D102	samples of
26 – 30		1	5	11	3	12	7	9	5	1				54	F	G36	drawings	E5	drawings
31 – 35		1	1	3	4	20	12	13	9	2		1		66	F	I37	below	G2	above
36 – 40				3	1	5	6	11	5		1	1		33	H	H37	medians	F43	medians (near Medians)
41 – 45				1	1	7	14	2	4	2	2	2		35	G	G47	(near medians)	D3	
46 – 50						4	6	4	12	2	3	3		34	I	H15		G69	
51 – 55						2	9	7	2	3	2	2		27	G	J38		H63	
56 – 60				1	0	2	8	12	5	5	3	2		38	H	J26		F86	
61 – 65						2	9	2	5	6	5	4		33	G	L16		J41	
66 – 70							2	2	0	13	6	5		28	J	L14		J10	
71 – 75							3	2	4	7	4	6		26	J	L19		J23	
76 – 80							1	1	2	2	4	3		13	K	H70		I38	
81 – 85									2	5	4	2		13	J	L10		I1	
86 – 90							1	1	1	8	7	3		16	K	K10		L5	
91 – 95										4	4	2		10	K	K4	J28, J6, K13, K2	J1	J17, K3, K1
96 – 100										–	–	–							
	10	131	179	109	64	126	112	100	66	55	45	36		1027					

Table IIa is to be read as follows: Of the ten kindergarten drawings of 'figure in action' six were assigned zero value, three were rated 1-5 and one 6-10; of the one hundred-thirty-one first grade (B) drawings, eighteen were rated zero value, thirty-two, 1-5, twenty-four were rated 6-10, etc. Reading from left to right, *e. g.*, the second horizontal line from top, the score interval

TABLE IIb

Showing Distribution of Scores on Tree by School Grades

COMBINED JUDGMENTS OF TWO JUDGES CONTROLLED BY LEGEND

Number of School Grades: Kdg'n I II III IV V VI VII VIII IX X XI XII

Symbols for Grades: A B C D E F G H I J K L

Score Intervals	Grade in Mode	6.8	9.32	30.64	51.74	57.24	57.33	60.85	61.22	63.49	67.65	73.07	Total	Type	4 samples below median				Median Samples	4 Samples above median			
0	C	9	18	5	1								33	B168					C260				
1 – 5	C	16	38	8	9	2	1						74	D22×	C146	C16	B17	D161	B172	C63	B68	C196	
6 – 10	C	9	15	7	3	5	1	1					41	C190	E24	C16	B171	D161	G11	C225	C75	C79	C269
11 – 15	C	5	10	8	7	2	3	1	1				37	C186×	F19	C4	E35	C13	J30	C35	E107	F67	B152
16 – 20	C	6	10	4	4	3	6	3	1				37	D170	C9	D170	C68	C241	E156	G140	F62	G38	G51
21 – 25	F	3	10	6	3	11	4	1	1				39	E16×	F40	F52	E175	F36	F190	B13	H89	E123	F9
26 – 30	F	1	8	7	5	9	4	4	3				41	F1	F22	C234	C22	C15	C271	D153	F70	C247	D134
31 – 35	D	1	5	12	10	4	9	7	5		1	1	55	H23	C259	D114	D101	D14	D163	B113	B164	D139	H75
36 – 40	E	1	4	4	12	6	8	11	7		1		54	E12	F144	G37	D54	D168	G143	H59	G159	H58	F75
41 – 45	G		3	2	11	10	13	12	8		2	2	63	G77	I93	H92	G66	G34	F175	F150	G119	H77	H78
46 – 50	G	1	3	7	7	7	12	7	2		2	1	49	E78	G86	H80	G122	G123	G96	G80	E78	H174	H135
51 – 55	H	1	3	4	10	9	9	13	6		1	2	58	E168	H179	F146	G48	I74	G84	G165	H175	G170	H137
56 – 60	H		2	10	18	14	15	19	17	2	1	3	101	H27	J61	H14	F136	H173	H107	F94	H144	F102	H37
61 – 65	H		1	2	12	11	10	19	11	1	4	8	79	H180×	H29	H146	H156	E164	I1	F109	F113	F108	K9
66 – 70	G		1	2	7	13	17	14	9		3	5	71	F91×	G132	F105	H116	H151	H147	E113	F149	F50	F165
71 – 75	H		1	1	13	14	11	17	11	1	1	6	76	I67×	E163	E166	I97	I73	E100	G128	G91	F114	F91
76 – 80	F				8	20	13	19	14	1	3	6	84	H5×	F97	F95	J67	G156	I74	I38	I58	H126	A5
81 – 85	G				5	2	9	7	6		3	5	37	I72	L12	F66	J60	H150	H78	G144	H180	E155	H17
86 – 90	L				2	1	3	1	1		2	5	15	L11	G44	G97	H134	L25	L11	K42	L9	L8	L10
91 – 95	L											4	4	L32	H177	G105	L28	L29	L32	L34	L39	H6	H4
96 – 100	K							1			2	1	4	L23	E161	L15	J47	F91	I67	G122	H18	H117	L35
		53	132	89	147	143	148	157	103	5	26	49 = 1052											

× Were selected for the Scale.

This table is to be read as Table IIa.

TABLE IIc

RESULTS OF RATING 1487 PUBLIC SCHOOL MEMORY DRAWINGS.
WORK OF FIVE JUDGES. THEME: HOUSE

School

Grades:	Kdgn	I	II	III	IV	V	VI	VII	VIII	IX	X	XI
Symbol for Grades	A	B	C	D	E	F	G	H	I	J	K	L

Score Intervals.	Medians of Grade Distribution: 4.69	10.22	14.45	20.93	23.98	31.46	36.70	41.43	41.03	42.99	48.11	Total	Grade (1) Mode	Type	Four samples below median	Median sample	Four samples above median
0	7	6	2	2								17	A	A37		O	
1 - 5	47	59	33	12	50	26	4	3	1		1	238	B	G27	B90, C4, C13, C37	B69	C34, F35, C81, 93
6 - 10	21	37	33	17	22	10	10	4	2	1	2	159	B	C32		E40	
11 - 15	9	25	28	16	18	10	8	8	2	2		126	C	F60		F27	
16 - 20	2	25	31	22	13	13	7	6	3	2	2	126	C	J26	Here were	D44	Here were
21 - 25	1	23	28	17	18	15	9	8	2	5		126	C	Q23	placed samples	G20	Placed Samples
26 - 30		12	23	16	8	16	16	13	10	3	7	124	G	K20	below median	C182	Above Median
31 - 35	1	12	15	10	6	21	16	29	14	14	13	152	H	F41	(Near Medians)	I12	(Near Medians)
36 - 40		1	9	8	5	4	8	9	13	13	7	78	I	H5		I54	
41 - 45			2	5	2	7	8	13	9	17	8	73	J	G95		I47	
46 - 50				1		3	11	8	8	11	5	48	J	B101		I41	
51 - 55				1	1	3	3	5	4	9	3	32	J	K48		J5	
56 - 60				3	3	4	6	11	5	13	4	53	J	H120		K61	
61 - 65						2	2	5	4	10	6	31	J	H69		H69	
66 - 70				2	1	1	2	2	4	6	5	27	J	K43		K75	
71 - 75					2	1	1	2	3	10	4	28	J	K79		J109	
76 - 80								1	2	7	4	17	J	J14		J60	
81 - 85								1	2	3	5	13	K	K45		J1	
86 - 90									1	3	4	10	K	L4		K89	
91 - 95										1	3	5	K	L1		K88	
96 - 100									1		1	4	L	L3		L3	
Total=	90	200	204	130	151	136	111	128	90	130	84	93		1487			

This table is to be read as Table IIa.

TABLE IId

SHOWING GRADE DISTRIBUTION OF RABBIT DRAWINGS UNDER CONTROL OF LEGEND

Grade, Grade: Kdgtn. I II III IV V VI VII VIII IX X XI XII
Symbols: Grades: A B C D E F G H I J K L M

Score Intervals	Medians of Grade Distribution 1.37	8.12	14.46	25.50	31.71	40.00	53.33	69.84	80.50	90.69	95.80	99.33	Total	Grade of Mode	Type	Four samples below median	Median sample	Four samples above median
0	38	29	28	7	6	2		3					112	A				
1-5	27	38	46	14	5	0							130	C	C21	B5, C105 C120 B11	C23	C107, C97, C98, D42
6-10	5	27	27	8	7	2							76	C	B99		B99	
11-15	1	17	22	22	6	5	2						75	C	D27		F57	
16-20		18	16	16	9	9	3	5	1				77	B	E31		E63	
21-25		5	8	13	12	5	8	2	1	2			66	D	E41		D113	
26-30		2	12	9	9	9	6	6	2	1			56	C	C8	Contained samples	E60	Contained samples
31-35		1	6	8	8	7	5	7	2	3			47	E	H68	of drawings below	D63	of drawings above
36-40			3	6	8	6	13	10	6	7			59	G	F49	median & (near medians)	F38	median & (near medians)
41-45			2	0	4	1	8	13	2	1			31	H	G42		G59	
46-50			1	3	2	0	5	14	0	1			26	H	E59		H101	
51-55				1	4	3	6	0	0	4			18	G	F7		G55	
56-60				0	2	4	8	12	1	1			28	H	G27		H90	
61-65				2	3	6	4	8	3	2			27	H	H101		J47	
66-70					3	4	2	11	13	7	2	2	44	I	G51		J17	
71-75					1	3	1	6	7	4	3	4	29	I	G69		H51	
76-80						1	2	6	5	12	0	3	29	J	I2		I16	
81-85								3	7	11	2	1	30	J	H106		I6	
86-90								3	3	15	4	5	1	31	J	H39		I9
91-95									3	7	5	3	3	21	J	K10		K10
96-100										6	6	2	2	16	K	J24	K2 J3 I29 J10	J19	L4 K8 K3 M2
Total =	71	157	171	113	88	66	73	109	56	90	22	20	6	=1022				

To be read as follows: 27 kdgtn. samples, 38 first grade, 46 second grade, 18 third grade, 5 fourth grade were scored 1-5. The most frequent sample was C, second grade; the type came from first grade B94; the median came from second grade, C23. Four samples better and four poorer than median are shown in second and bottom line only.

the samples of an interval were distributed in a serial order from the poorest to the best. In addition to the median, four drawings just better, and four just poorer, than the median, were recorded as 'near medians' which afforded an additional control in selecting samples for further treatment. A complete record of such 'near medians' is shown in Table IIb. The computed median of each grade or school year distribution is given under 'medians' and just above the frequency distribution column of the grade.

In these and similar tables based upon the distribution of 'house,' 'rabbit,' 'figure in action,' and 'tree,' the drawings

TABLE III

SHOWING MEDIAN SCORE BY SCHOOL GRADES

(Distribution Under Control of Legend)

		School Grades											
Themes	Kdgtn.	I	II	III	IV	V	VI	VII	VIII	IX	X	XI	X
House ...4.68	10.72	16.95	20.53	11.41	23.99	31.45	34.78	40.22	49.62	47.99	69.11		
Rabbit .. o	6.27	8.12	16.46	25.50	31.71	40.80	43.32	69.84	80.50	90.50	85.50	94.	
Figure in action . o	9.22	14.08	16.86	18.09	24.32	38.49	33.68	45.50	68.49	71.61	68.99		
Tree .... o	6.80	9.32	30.64	51.74	57.24	57.33	60.85	61.22	63.49	67.65	73.07		

The Median Score was computed from the grade distributions shown in Tables IIa, b, c, ar
These Scores show roughly the Progress of Drawing through the grades as determined by the Le
distribution.

of each school year as shown by mode, type, median, and 'near median' samples, conform in the main, exception to be noted later, to the general order of the students' progress through the grades. The same fact is expressed about these four themes in Figure I, based upon the computed median of the scores in a grade distribution. See also Table III.

The rise of three of the curves is gradual, with no plateaus and with few set-backs. The house curve, with the exceptions of fourth and tenth year, is rather remarkable for its gradual uniform rise. But the achievements in the brush drawing of a tree follow quite another line of progress. Table IIb shows that samples from fourth (E), fifth (F), and sixth (G), grades were scored with well nigh equal frequency along with those of the junior and high school grades. The rise of the tree curve, Figure I, is steep until the fifth

year is reached, but from then to the tenth year, the improvement from year to year is slight, forming a marked plateau. A possible explanation of the form of the tree curve may be found by comparing the score values of the tree drawings

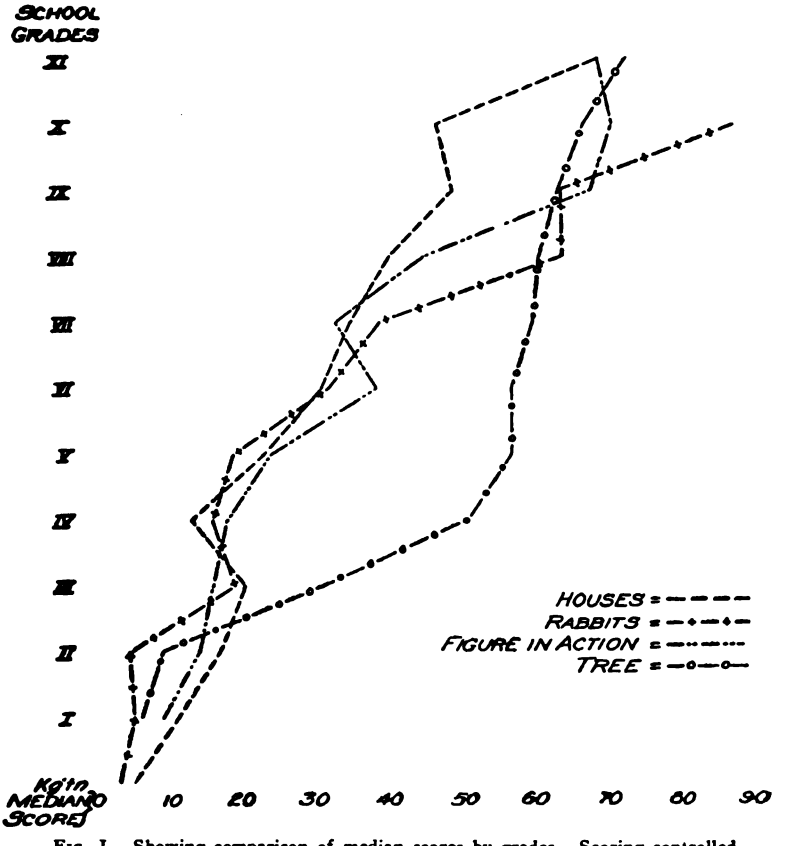


FIG. I.—Showing comparison of median scores by grades. Scoring controlled by legend and type drawing. (Rabbit curve based upon medians not given in Table III.)

with the principles of the legend. The third score group of the legend has a range from 31-55 (see legend for representation) and received drawings with degrees of merit in proportion and form. It appears that the use of the brush enables pupils in the earlier school years to achieve success

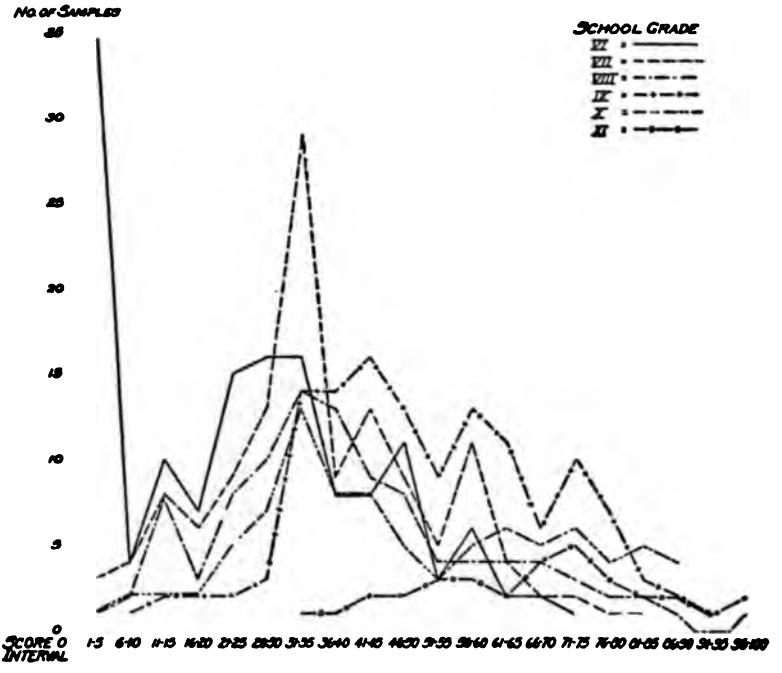


FIG. IIA.—Showing distribution of scores under control of legend on drawings of houses, 576, by school grades VI to XI.

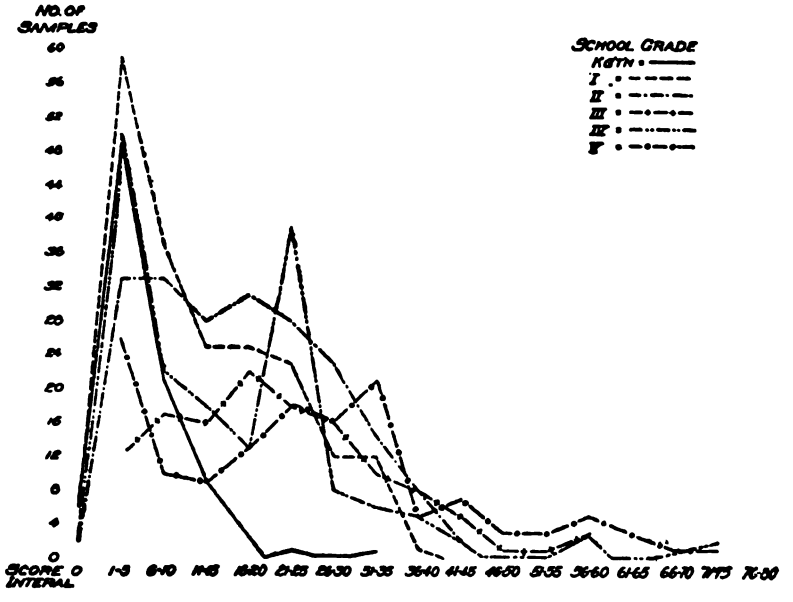


FIG. IIB.—Showing distribution of scores under control of legend on drawings of houses, 911, by school grades kindergarten to V.

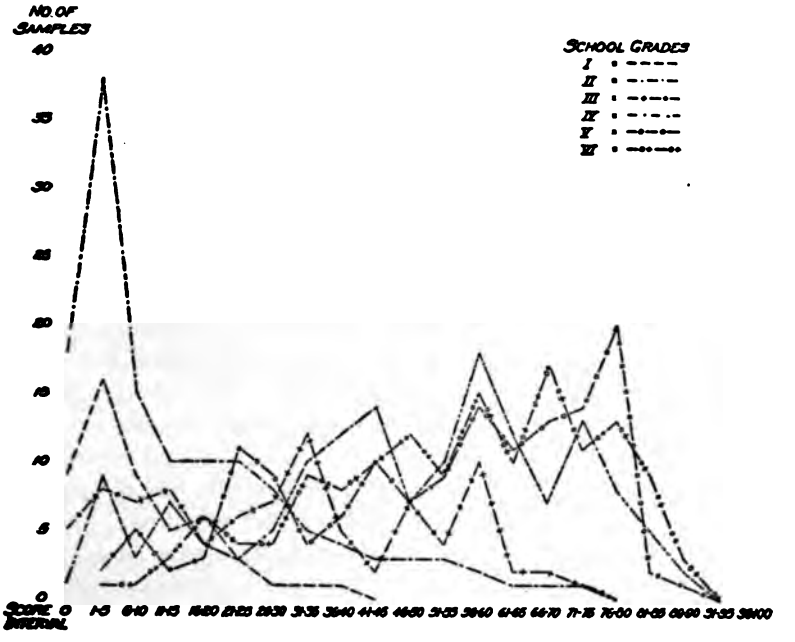


FIG. IIIA.—Showing distribution of scores on drawings of trees by school grades I to VI.

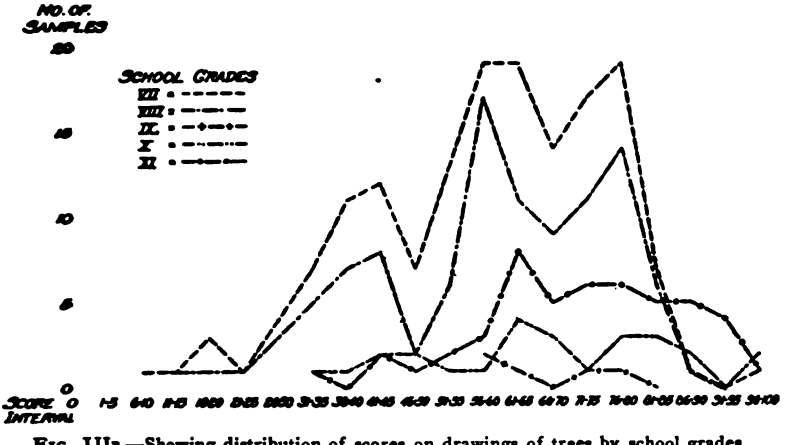


FIG. IIIB.—Showing distribution of scores on drawings of trees by school grades VII to XI. [Under control of legend.]

with this principle only. A drawing, to be scored higher than 31-55, for example in the 56-75 score group, must show "minimum of artistic qualities such as growth, texture and structure in * * * living forms." It should also be noted that defects in proportion and in relation between parts in a brush drawing of a tree are not as evident as the same qualities in a house, an animal, or in the human figure.

The tree drawings done by all of the higher grades, beginning with the sixth, expressed, according to the judges, only a minimum amount of the artistic qualities as specified in score group No. 4 of the legend. This fact doubtless accounts for the marked plateau in the tree curve. Similar plateaus in children's drawings, some beginning with the fourth year, have been found by Barnes, Lukens, Childs, and others.

There is a decided drop in house, rabbit, and figure in action curves, Figure I, at the fourth grade, and a similar drop in figure in action and rabbit occurs at seventh grade. This latter drop is made more noticeable by the rapid rise of both curves in the eighth and ninth grades. A consideration of the probable cause or causes of these fluctuations and sudden ascents is postponed to Part II, when more material is available.

Figures IIa and IIb of house samples, and those of IIIa and IIIb of trees, based upon the absolute number of score frequencies (Tables IIb of tree samples and IIc of house samples), show wide range of achievements in all school grades and marked overlapping in both directions; i. e., the scores of any grade coincide with those made by grades above and below it. House samples of third grade, for example, were scored from 1-5 to 66-70 and those of sixth grade from 1-5 to 71-75 showing a slight range above the third grade. This condition is similar to the findings of pupil achievements in other school subjects, as reading, spelling and writing (Starch, E. D.), arithmetic (Woody, C.) and in history (Bell and McCullum). An inspection of the figures shows, however, that the upper limits of the curves, with exception of that of house in tenth grade, end in the order of the priority of the school year.

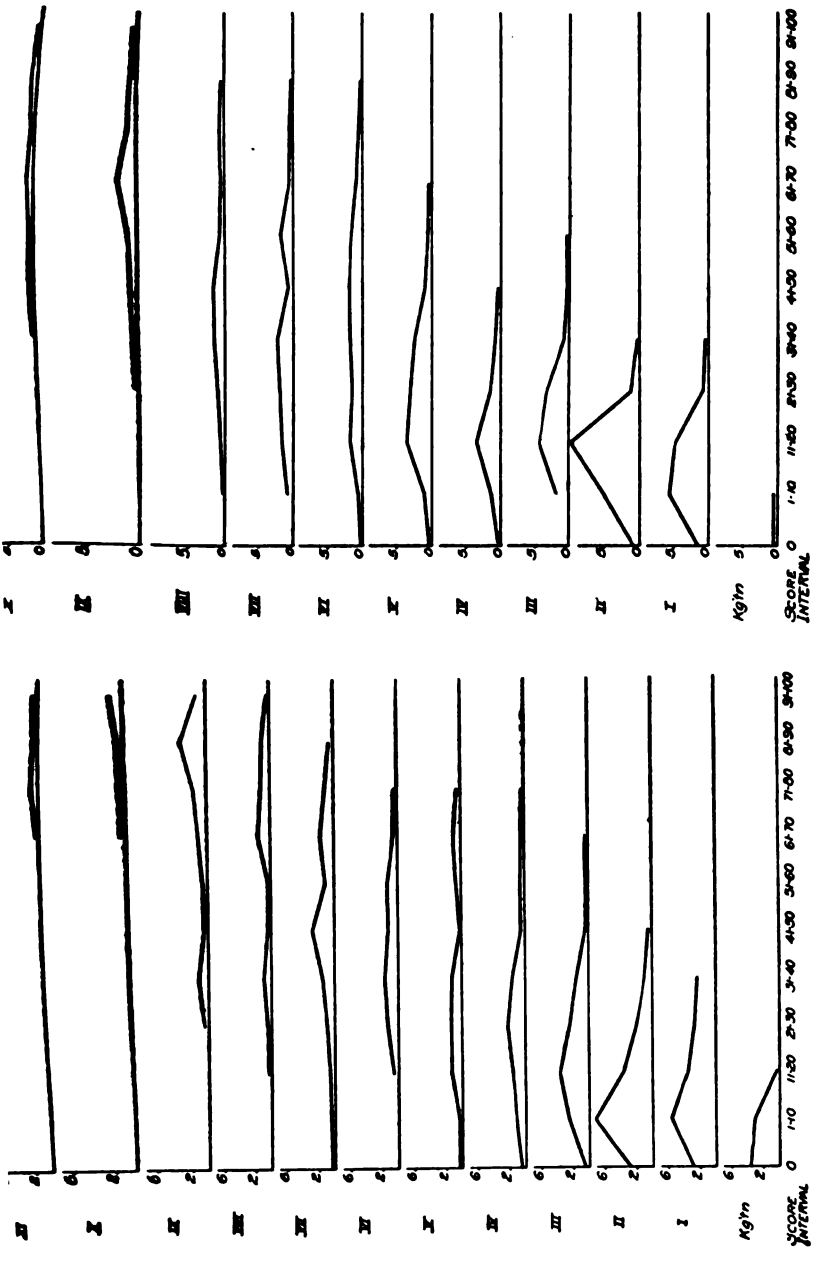


Fig. IV.—Showing overlapping of curves of rabbit drawings by school grades, based upon per cent of score frequencies.

Fig. V.—Showing overlapping of curves of figure in action drawings by school grades, based upon per cent of score frequencies.

In order that the overlapping by grades may be more easily seen Fig. IV, 'rabbit' samples, and Fig. V, 'figure in action' samples, are constructed from per cents computed from the score frequencies per school grade, the total number of samples in each theme being taken as base. For example, the total distribution of rabbit drawings was 1022 (Table IIb). In grade I, 29 samples or 2.8% of 1022 were scored 0; 65 samples or 5.4% were scored 1-10; 35 samples or 3.8% were scored 11-20; 7 samples or .7% were scored 21-30; and 1 sample or .1% was scored 31-40. The score intervals of the weighted legend are doubled in the construction of these two figures.

These curves reinforce with some emphasis the phenomenon of overlapping and indicate a steady increase in achievement

III. SELECTING AND SCORING SAMPLES OF EACH THEME

1. Type, Median, Near Median, and 75%-Agreement Drawings Chosen

It was now possible to select drawings from four sources for further treatment: (1) those that had been 'types' during the distribution; (2) those that had been placed in the median position when the samples that had been given the same scoring were serially arranged; (3) those receiving the same score by 75% or more of the judges; (4) those that had been 'near medians' in the serial distribution of the scored drawings. It happened at times that the same drawing served as type, later as median, and finally received similar ranking by three-fourths of the judges. Samples that did not fall in one or more of these four classes were rejected. Samples having such a history or pedigree were used in making up a list of 63 drawings for the next type of scoring.

These 63 drawings selected under controlled conditions had a range of qualities embodying the essential principles of drawing in Representation and extending throughout the public school grades, i. e., they showed the entire gamut of drawing achievements as now done in the public schools.

2. Rating the 63 Samples by 22 Judges

The drawings were now re-scored by 20 or more judges under the guidance of the legend. The directions for scoring were similar to those used in the former distribution with the exception that the 'type' was omitted—no longer needed—and that the median was not placed or located among samples of each score interval by serial arrangement. The distribution was made on long tables (see photograph, page 14) and a sample was scored wherever it was deposited by a label bearing a score interval. Sixty-five of the 92 judges participated in this work. Twenty-four or 37% were teachers of drawing or artists, 34 or 52% were public school and college teachers, and 7 or 11% were laymen and art students.

TABLE IVa

Showing Distribution of Scores of 63 Samples Made by 22 Judges

Theme: House

Sample	Score Interval	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100	Med.
A		19	3																				0
B		20	1	1																			0
C		19	3																				0
D		6	14	1	1																		2
E			12	7	2	1																	5
F			12	8	9				1														5
G			7	11	1	1				1	1												7
H		1	7	7	6				1														8
I			6	10	3	1	1			1													8
J			2	7	7	3				1			1	1									12
K			5	3	4	8		1	1														14
L				4	7	4	4	1	1		1												15
M			1	6	3	8		2			1		1										16
N				4	3	7	2	1	2	1	1	1											18
O				2	7	3	2	2	4					1		1							19
P				4	2	6	3	3	1	1		1		1									20
Q			1	4		6	5	1	3					1	1								20
R				3	4	3	3	4	2		2				1								22
S				2	4	2	8	1	2	1		1		1									22
T				1	2	8	4	5	2					2				1					24
U				2	4	2	4	3	4		1			1		1							24
V					2	4	6	3	3	2				1	1								25
W					6	2	8	3	2	2				3	1								25
X				1		3	3	10			1			3		1							27
Y					2	4	2	4	3	2		1		2		1	1						29
Z					3		3	2	7	3	1		2	1									33
AA					2	4	1	2	3	3	1	1	3	1		1							34
BB					1	1	3	1	5	6	2		2	1									35
CC				1	1	4		2	2	7		4	1										36
DD					1	1	1		5	6	1	3	1	2			1						38
EE						2		1	3	10	3	1		1		1							38
FF					2	2		1	3	3	3	5		1	1	1							40
GG						1	3		3	2	5	3	3		1		1						43
HH								1	4	1	6	3	3	3	1								45
II							3	2		1	5	3	3	1	1	1	1	1					45
JJ						1	1	1	1	1	4	6	2		4	1		1					48
KK						1	1		1	2	3	6		3	2	2		1					49
LL								1	1	2	5	2	4	3		3		1					50
MM							2		1	3		2	6	1	3	3		1					53
NN									2		2	1	8	1	2	2		2	2				54
OO								3	1	2	2	1	2	1	2	2	3	3					55
PP								1		1	2	1	5	7		1	3	1					56
QQ								1	2			4	3	5	2	2	2	1					57
RR					1				2			3	3	7	2	3	1						57
SS							1	1		1	1	3	3	1	5	4	2						60
TT										2		3	3	1	1	4	3	2	1	2			62
UU									1	1		2	2		4	3	4	2	2	1			62
VV												1	1	1		3	6	9	1				75
WW										1				1		3	3	7	1	2	3	1	78
XX														3	3		2	5	6	2	1		79
YY												2	2		1		1	8	4	3		1	79
ZZ												1	1		1	2	1	7	5	3	1		79
AAA										1			1			2	2	6	3	4	2	1	80
BBB									2							1	2	7	3	3	4		80
CCC											1	1		1		3	2	1	8	3	2		82
DDD													3		2			4	7	2	3	1	82
EEE				1						1				1			2	4	7	1	3	2	82
FFF								1	1							1	2	3	8	6			82
GGG													1	1	1	1	2	2	7	2	3	2	83
HHH												1	1					5	6	8		1	88
III																2		2	6	8	3	1	88
JJJ															1	1				2	4	14	92
KKK																					4	18	97

This Table is to be read: Sample B46 was scored 0 by 19 judges, and 1-5 by 3 judges. The median is 0. Sample was scored 0 by 6 judges, 1-5 by 14 judges, 6-10 by 1 judge and 11-15 by 1 judge. The median = $1 + \frac{11-6}{14}$ = 2.79. Samples underscored were later ranked in serial distribution.

TABLE IVb

Showing Distribution of Scores of 63 Samples Made by 22 Judges

No.	Name of Sample	Interval	Theme: Figure Eradication																									No.
			0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100					
1	A2		19	1	2																							0
2	A5		20	2																								0
3	B35		18	1	2	1																						0
4	B38		16	2	1	2	1																					0
5	B49		5	12	2	1	2																					3
6	B62		1	11	1	4	1	3	1																			5
7	B86		1	10	4	4	1	1		1																		6
8	B120			7	5	2	1	2		1																		5
9	B45			4	6	4		1	1	1	1																	5
10	B116		2	2	10	3	2	1	1	1																		4
11	D42			7	5	4	2	1	2				1															11
12	B32		1	9	1	4	1	1		1		3	1															11
13	B89			2	9	3	3	1	1	1	1		1															11
14	B115			2	6	8	9	4	1	1				1		1												15
15	C125		1	4	3	2	3	1	2	3	1			1	1													15
16	D27			4	1	4	4	1	5	1	1		1															11
17	C150				2	7	3	1	1	3	2	2		1														11
18	D57				2	5	9	1	1	1	1		3	1	3													2
19	D44			2	2	5	2	3	2	1	3	1	1															2
20	C119			1	5	1	2	4	3	5	1																	2
21	C129			1	1	4	3	3		2		5		2	1													2
22	B109				2	4	2	4		3	1		2	1		3												2
23	C76				4	3	1	3	2	1	3	1		4														2
24	F86				2	1	5	3	3	1	2	1	1	2		1												2
25	D61				1	5	3	1	4	1	2			1	1	3												2
26	E79				3	2	2	3	4	2	1			2	3													2
27	D3			2	3		3	2	3	3	3	1	2															2
28	G85					1	4	3	4	1	2	2	2	2	1													2
29	C73				1	1	3	3	3	1	2	3	3	2														2
30	C174				2	2	3	3	1	3		2	1	2	2	1												2
31	D45				2	2	4	1	1	3	7			2														2
32	J26					1		2	3	2	4	3	3		2	1	1											3
33	D98				1	2	2	4			2	2	2	1	3		3											4
34	C9				1	1	1	2	3	1	2	1	4	3	1	2												4
35	L9					1		1	2		1	5	3	3	5		1											4
36	J10							1	2	1	1	5	1	1		4	2	4										3
37	L16								3	1		2	2	3	3	4	1	2	1									3
38	L17					1				2	1	2	1	2	0	4	1	1		2								4
39	K18									1	1	2	3	2	3		1	5	3		1							4
40	K37								1		2	1	3	1	3	3	3	4	1									4
41	K1							1			2	1	4	1	1	2	3	7										4
42	K10						1		1	1	1			3	2	3	2	2	2	2	2							4
43	I35									1		1		4		6	5		4			1					4
44	I30									1		2	4	1		3	4	3	2	2								4
45	I9													3	2	5	3	6	2		1	1						4
46	J12												3	1	2	3	6	3		5								4
47	J14								1	1			2	1	1	4	2	2	2	1	3	2						4
48	L5								1	1			1	1	1	3	2	3		6	2	1						4
49	Q82							1				1	1	1	1	3	2	2	7	1	1	1						4
50	K6							1				1	1	3	1		1	4	6	2	2							4
51	J8								1		1				4	2	2	1	3	4	1	1	2					4
52	J11												2		5	2	1	1	4	7								4
53	J24										1		2	2	1	1		4	1	4	4	2						4
54	L10									1			1	3	4	1		1	4	5	2							4
55	N20								1		1	1	1	2	2		1		2	3	4	3						4
56	F5												1				1	3	6	4	2	4	1					4
57	J1												1				4	3	3	6	3	2						4
58	K3										1						1	2	7	1	6	4						4
59	L1													1	1		2	1	3	4	5	4	1					4
60	J17															3	1	1	1	2	11	3						4
61	F58															2	1	1	3	1	2	5	7					4
62	K9																		1	3	1	9	8					4
63	K21																		1		6	3	12					4

To be read as Table IVa.

TABLE IVc

SHOWING DISTRIBUTION OF SCORES ON 19 OF 63 SAMPLES MADE BY 21 JUDGES

Theme: Rabbit

Name of Score / № Sample	Interval	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100
1 B27		11	10																			
2 G23		4	8	6	2	1																
3 E59		1	3	6	6	3	1			1												
4 E73			1	3	6	5	3	2				1										
5 E63			2	4	1	4	6	2		2												
6 E60			1	1	5	1	6	4	1	2												
7 D67					1	2	6	3	2	1	3	1	2									
8 E49			1	2	1	2		4	1	3		3	1		3							
9 H97						4		1	1	5	2	1	1	1	1	2	2					
10 D63						1	1	1	4	2	4	2	1	4				1				
11 H63						1	2	2	1	1		7	4	2			1					
12 H60						1		2		2	2	4	3	5	1	1						
13 H51										2	2	1	2	6	5		2	1				
14 J47									1				4	2	1	3	7	3				
15 J49												1	3	1		2	2	3	7	1		
16 I34												1	1		1	2	3	3	2	3	2	3
17 I9															2		1	3	5	4	3	3
18 H104											1				1	1	3	1	1	5	4	4
19 K10															1			1	6		9	9

This Table is to be read as IVa. [Only 19 of 63 samples that were distributed appear here. Sample should have been omitted. Since 42 of the original 68 were discarded there is no necessity for presenting scores. Tables IVa and IVb show the character of the whole distribution.]

TABLE IVd

SHOWING DISTRIBUTION OF SCORES ON 19 OF 63 SAMPLES MADE BY 20 JUDGES

Theme: TREE.

Name of Score / № Sample	Interval	0	1-5	6-10	11-15	16-20	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65	66-70	71-75	76-80	81-85	86-90	91-95	96-100
1 B10		14	6																			
2 D22		2	10	6	1		1															
3 I4			3	5	3		4	3	1	1												
4 E16		1	2		6	2	9	1	2	1												
5 C136			1	2	3	4	1		8		1											
6 G65				1		1		4	1	6		1	3	1		1	1					
7 E124					1	1		2	2	3	2	2	1	4	1	1						
8 H126							1	1		1	1	2	2	6	1	1	1		3			
9 E178										3		2	9	1	4		3		2	1		
10 H164										1		4	1	3	3	2	2	3	1			
11 E141							1	1			1		1	3	5	2	2	1	2		1	
12 I61						1				1	1	3	2		2	3	3	3	1			
13 H5										1	1		2	1	1	3	2	2	4	2		1
14 E153															4	1	2	3	6	3	1	
15 H150										1				1	3	2		3	1	4	4	1
16 K15																3	2	6	5	1	1	2
17 E91															1			5	4	6	1	3
18 G93								1					1			1	1	2	1	3	8	2
19 K10								1									1	3	2	1	9	5

This Table is to be read as IVa.

TABLE V

SHOWING HISTORY OF A FEW OF THE 63 SAMPLES CHOSEN FOR FURTHER DISTRIBUTION *

Theme	Name of sample	Median	Near median	Type	75%-Agreement
House.	B 1[1]	Median	.....	.....	.....
	A 17[1]	.....	.....	Type	.....
	B 131[1]	.....	Near median	.....	.....
	K 89[1]	.....	.....	Type	75%-Agreement
Rabbit.	K 10[3]	Median	.....	Type	.....
	I 9[3]	.....	Near median	.....	.....
	J 47[2]	.....	.....	Type	75%-Agreement
	E 60[3]	Median	.....	.....	.....
Figure in action.	A 5[5]	.....	.....	Type	.....
	K 37[5]	.....	.....	.....	75%-Agreement
	K 2[2]	.....	Near median	.....	75%-Agreement
	L 5[5]	Median	.....	.....	75%-Agreement
Tree.	H 180[4]	.....	.....	Type	.....
	I 61[4]	Median	.....	.....	.....
	L 10[4]	.....	Near median	.....	.....
	E 16[4]	.....	.....	Type	75%-Agreement

* It should be borne in mind that three samples were chosen for each of the score intervals ranging from 0 to 100, e. g., three drawings rated 1-5 were placed in the 1-5 interval, the three in each interval being of about the same value, of course.

3. BASIS FOR SELECTING 21 SAMPLES

A. DISTANCE BETWEEN MEDIAN SCORES

The results of scoring the 63 samples of each theme are assembled in Tables IVa, b, c, and d. Tables IVb and IVd present only those samples that were later chosen for scoring in the serial distribution.

Since 21 score intervals appeared to have sufficed thus far for scoring purposes, it was decided that the authors should select 21 samples from the 63, discarding 42, and have them redistributed serially, i. e., have them arranged in a series from the poorest to the best.

The samples are listed in the tables according to the array of the median values computed from 20 or more judgments on a single sample. A study of the tables shows that the difference between successive medians in the array for

figures in action varies from 0 to 5 units, for houses from 0 to 11.09 units; this latter difference occurs next to the last in the array and is more than twice the size of the usual largest steps. The distance between the steps, according to the medians, in the rabbit array—not shown in the table—varied from 0 to 5.83 units, and the distance between steps in tree array varied from 0 to 8.08.

The number of times in which there was zero difference between adjacent medians in scoring the drawings of the house was 6, the number for the tree scoring was 7, and in the case of the rabbit and figure in action 11 and 13, respectively. It is suggested that the relatively small number of zero differences between adjacent medians occurring in the case of the house drawings point to a greater variety of distinctive, progressive, and recognizable differences. The fine graduated differences in the living forms, rabbit and figure in action, are much more difficult to discriminate, and as a consequence, a greater similarity of grouping occurs. The average difference between the medians is highest for the house drawings, 1.99 units, while for the tree it is 1.33. The average difference for rabbit and figure in action stand 1.37 and 1.48, respectively; the greater difference of the figure in action is not clear.

It would have been possible, if desirable, to have selected 12 or 15 samples from the 63 with well nigh equal differences between their medians. Fourteen samples, not including zero, whose successive medians differed each by an interval of 6- and A D-.22 could have been selected from the drawings of rabbits. Thirteen whose medians differed by an interval of 6.46, A D-.63, could have been selected from the drawings of houses. Fifteen samples whose medians differed by a constant interval of 6, A D-1.2, could have been selected from drawings in action. When other conditions were equal, equal differences between medians determined the selection of the sample. In Tables IVa and IVc, the symbols of samples and the medians in heavy type mark the drawings selected for further scoring.

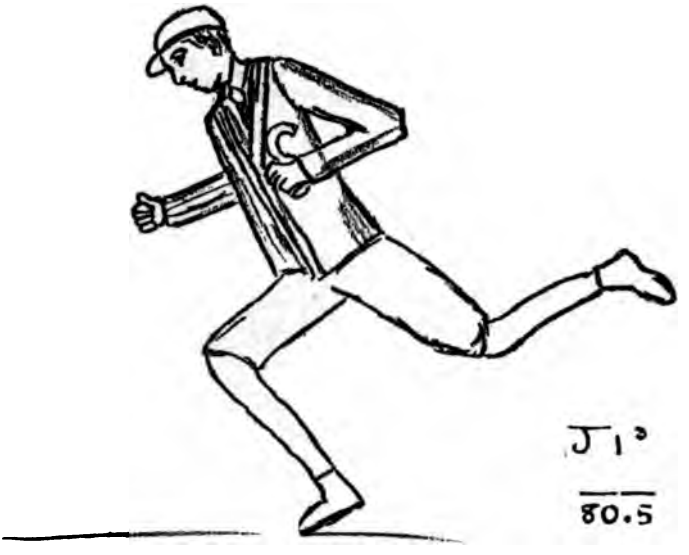
B. ACCORDING TO PRINCIPLES EMBODIED IN THE LEGEND

If equality of steps between the units of an educational scale had been the only object of the search, the investigation might well have stopped here. But when the samples having medians differing by equal intervals were compared with others having unequal intervals and both were checked by the principles of the legend, it was strikingly evident that

some samples occupying equal steps were easily surpassed by others having unequal steps for purposes of scale construction, e. g., in the figure in action samples $K6^3$ and $J8^3$ were rated 74.7 and 75.5, respectively, by 22 judges, and in the process of reducing the number of drawings from 63 to 21, obviously, one of these must be rejected. While $J8^3$ has defects as a drawing of a figure in action, as a whole the proportions are better, the lines more expressive, and the manner of suggesting the features more desirable at this *step*

in the scale. *K6*[3], while expressing action unmistakably, represents so many undesirable features, such as undue attention to details, lack of structure and proportion, rather than an effort to express the main action lines, through a study of direction, proportion, and subordination of details, it would, obviously, be of far less use to the pupil and teacher than *J8*[3].

Again, samples *J1*[3] and *I5*[3] were rated 80.5 and 80.5, respectively, by 22 judges, and as such were competitors for a



place in the scale. While *J1*[3] has much to recommend it as a type of the figure in action, the lines are hard and angular, have less variety and character, and are less expressive of the human figure than those of *I5*[3], making *I5*[3] a better type of drawing for use in the school room *at this step* in the scale.

A third principle somewhat coordinate with those of "A" and "B" employed in reducing the 63 samples to 21 consisted in making use of some characteristic, other things being equal, possessed by a sample over others that qualified it for measuring drawing achievements in the school room.

This factor will appear upon reading the "analytic description of samples" given in some detail with the scale pictures. A concrete case may be in order here, however. Sample $A17^1$, median value 8.14, No. 3 in the house scale, competed with two other samples having medians 7.8 and 8.5, respectively, and was chosen because it represented more clearly than either of the other two the common failure of pupils at this step to distinguish between the upright line that represents a corner of a building and the line that forms a part of the gable end. The two lines are drawn by the pupil as one and the same straight line.

The 63 samples of each theme were repeatedly worked over in this way until a set of 21 samples were chosen.

4. Scoring 21 Samples by Serial Distribution

The directions to the judges for this final scoring were as follows

To the Judges:

You are asked to arrange the 21 drawings enclosed in this envelope in order from the poorest to the best, and record the order that you assign to each drawing on the enclosed blank sheet.

In judging the drawings consider them from the standpoint of "representation" only. Observe such features as proportion, balance, light and shade, and quality of line to show growth and texture.

The legend was not used.

Thirty-two of the 92 judges scored the drawings by the serial method. The status of the judges in their relation to art knowledge and experience is given here in tabular form.

Drawing theme	No. of judges who taught drawing	No. of judges who had not taught drawing
House	7	7
Rabbit	10	2
Figure in action	7	5
Tree	1	13

A. Results of Serial Distribution

Tables VIa, b, c, and d show the results of the serial distribution: the medians, and the per cent rank of each sample in the total distribution. The high degree of correlation between the array of the per cent ranks of the serial

TABLE VIa

Showing Judgments in Serial Distribution of House Samples [14 Judges]

Rank	0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		Median	Per cent
Name of Sample	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%		Rank
1 A60	14	100																																									0.00	0.00
2 B1			11	78.57	3	21.43																																				1.64	5.77
3 A17			3	21.43	10	71.43	1	7.14																																			2.40	8.84
4 B131					1	7.14	8	57.14	3	21.43	2	14.28																															3.29	16.33
5 B162							2	14.28	7	50.00	2	14.28	3	21.43																														4.71	21.08
6 D59							3	21.43	1	7.14	7	50.00	3	21.43																														5.43	22.45
7 D64									1	7.14	2	14.28	6	42.85	4	28.57			1	7.14																								6.60	29.59
8 H59													2	14.28	8	57.14	3	21.43	1	7.14																								7.67	34.35
9 G92									2	14.28	1	7.14					7	50.00	2	14.28	2	14.28																							8.57	38.71
10 X53															1	7.14	4	28.57	5	35.72	4	28.57																							9.40	42.17
11 H69															1	7.14			3	21.43	3	21.43	5	35.72	2	14.28																			11.00	48.69
12 H120																			2	14.28	4	28.57	6	42.86	2	14.28																			11.67	50.34
13 J62																					1	7.14			5	35.72	5	35.72	2	14.28					1	7.14									13.20	62.09
14 H106																							3	21.43	3	21.43	1	7.14	3	21.43	3	21.43	1	7.14									14.00	63.00
15 J59																									2	14.28	3	21.43	5	35.72	2	14.28	2	14.28									14.40	66.33
16 K46																											2	14.28	3	21.43	5	35.72	1	7.14			3	21.43					15.43	72.10
17 J3																											1	7.14			4	28.57	7	50.00	2	14.28							16.29	74.50
18 J109																													1	7.14			2	14.28	9	64.30	2	14.28					17.44	80.95
19 K75																											2	14.28							2	14.28	9	64.30			1	7.14	18.33	84.01
20 K89																																							12	85.72	2	14.28	18.57	85.15
21 L200																																	1	7.14					2	14.28	11	78.57	20.30	93.20

Table to be read: Sample A60 was assigned zero rank by 14 judges. Sample A17 was assigned rank 1 by 3 judges, rank 2 by 10 judges and rank 3 by 1 judge. The median for this sample is $2 + \frac{7-3}{10} = 2.40$, and the per cent rank in the total distribution is $\frac{(3 \times 1 + 10 \times 2 + 1 \times 3)}{294} \times 100 = 8.84$.

TABLE VIb

SHOWING JUDGMENTS IN SERIAL DISTRIBUTION OF RABBIT SAMPLES [12 JUDGES]

Sample	Ranks 0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		Median	Percent
* No.	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%		Rank
1 B27	10	83.33	2	16.66																																							0.00	.79
2 C23	2	16.66	10	83.33																																							1.80	3.96
3 F57					10	83.33	1	8.33			1	8.33																															2.60	11.11
4 E73					1	8.33	8	66.66	1	8.33	1	8.33	1	8.33																													3.63	16.27
5 P63					1	8.33	1	8.33	5	41.66	1	8.33	4	33.33																													4.80	21.42
6 D57							1	8.33	4	33.33	3	25.00	1	8.33	3	25.00																													5.33	24.20
7 E60									1	8.33	5	41.66	3	25.00	2	16.66	1	8.33																											6.80	27.38
8 F49									1	8.33			3	25.00	4	33.33	1	8.33	2	16.66			1	8.33																			7.30	34.52
9 D63											1	8.33					6	50.00	3	25.00	1	8.33	1	8.33																			8.83	40.07
10 H97							1	8.33							2	16.66			3	25.00	5	41.66					1	8.33															9.50	42.46
11 H63															1	8.33	3	25.00	2	16.66	4	33.33	2	16.66																			9.50	44.04
12 H60																					1	8.33	5	41.66	6	50.00																	11.50	54.36
13 J49																			2	16.66	1	8.33	1	8.33	2	16.66	2		1	8.33	3	25.00											12.50	58.73
14 J47																	1	8.33					1	8.33	1	8.33	3	25.00	4	33.33	1	8.33			1	8.33							13.50	62.62
15 H46																									2	16.66	3	25.00	2	16.66	2	16.66	2	16.66			1	8.33					14.50	68.85
16 H51																									1	8.33	2		1	8.33	2	16.66	3	25.00	2	16.66	1	8.33					15.50	72.22
17 J29																							1	8.33			1	8.33	3	25.00	1	8.33	4	33.33	2	16.66							15.50	71.03
18 K24																													1	8.33	1	8.33	2	16.66	3	25.00	5	41.66					16.22	80.15
19 B9																															2	16.66	1	8.33	4	33.33	1	8.33					17.75	81.34
20 A109																																					1	8.33	10	83.33	1	8.33			19.50	90.47
21 K10																																							1	8.33	11	91.66			20.16	94.84

The per cent of number of judgments made for each position in ranking a sample is given in Tables VIa, b, c and d to show the possibilities of using the principle of "over lapping" medians to compute distance between them. See Table VIIa.

TABLE VIc

SHOWING JUDGMENTS IN SERIAL DISTRIBUTION OF FIGURE IN ACTION SAMPLES [12 JUDGES]

	Name of Sample	Ranks 0		1		2		3		4		5		6		7		8		9		10		11		12		13		14		15		16		17		18		19		20		Median	Percent Rank
		No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%		
1	A5	12	100																																									0	
2	B68			12	100																																						50	4.76
3	B86					5	42.66	6	50	1	8.33																																3	17	12.70
4	D42					4	33.33	5	42.66	1	8.33	2	16.66																														3	40	14.65
5	C119					2	16.66			3	25.00	2	16.66	4	33.33	1	8.33																										5	50	22.61
6	F79					1	8.33			3	25.00	2	16.66			5	42.66					1	8.33																				6	60	27.38
7	D98							1	8.33	1	8.33	1	8.33	1	8.33	1	8.33	4	33.33	1	8.33	2	16.66																				8	75	34.12
8	C150									2	16.66	1	8.33	3	25.00			3	25.00	1	8.33	1	8.33			1	8.33																7	60	34.12
9	B115													3	25.00	4	33.33	3	25.00	1	8.33	1	8.33																				7	58	35.31
10	C93									1	8.33	2	16.66	1	8.33	1	8.33			2	16.66	2	16.66	2	16.66	1	8.33																9	80	39.28
11	D104											2	16.66					1	8.33	5	42.66	2	16.66	2	16.66																		9	60	41.66
12	K37																	1	8.33	1	8.33	3	25.00	2	16.66	2	16.66	3	25.00														11	50	52.38
13	L16																			1	8.33			6	50.	3	25.00			2	16.66												11	83	55.15
14	J8																									3	25.00	4	33.33	3	25	2	16.66										13	75	63.49
15	L5																									1	8.33	2	16.66	2	16.66	2	16.66	3	25	1	8.33	1	8.33				15	50	71.03
16	J14																									1	8.33	2	16.66	2	16.66	2	16.66	3	25	1	8.33						15	50	71.82
17	I5																											1	8.33	1	8.33	1	8.33	5	42.66	2	16.66			1	8.33	1	8.33	16	60	77.35
18	I58																													2	16.66	1	8.33	1	8.33	2	16.66	2	16.66	3	25	1	8.33	17	50	81.74
19	K3																															1	8.33	2	16.66	3	25.00	4	33.33	2	16.66			17	50	82.53
20	K2																															3	25			1	8.33	3	25	4	33.33	1	8.33	18	66	84.12
21	J18																																					1	8.33	2	16.66	9	75	20	83	93.65

Table to be read as VIa. Array of samples according to per cent rank instead of median rank.

TABLE VId

Showing Judgments in Serial Distribution of Tree Samples [14 Judges]

No.	Name of Sample	Ranks 0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	Median	Percent Rank
		No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %		
1	B10	14 100																					0.0	
2	D22		14 100																				1.50	4.76
3	E4			9 64.29	4 28.57	1 7.14																	2.67	11.54
4	E16			3 21.43	5 35.71	4 28.57	2 14.29																3.50	15.38
5	C116			2 14.29	4 28.57	6 42.86	2 14.29																4.17	17.00
6	G85					1 7.14	1 7.14	3 21.43	3 21.43	2 14.29	1 7.14												6.67	28.93
7	F124				1 7.14		3 21.43	4 28.57	3 21.43	1 7.14			2 14.29										6.75	31.63
8	H176					2 14.29	1 7.14	4 28.57	1 7.14		1 7.14		3 21.43	2 14.29									6.50	32.91
9	H173						2 14.29	3 21.43	1 7.14		3 21.43	1 7.14	1 7.14	1 7.14	1 7.14	1 7.14							9.33	38.09
10	I67								5 35.71	2 14.29	1 7.14	1 7.14	2 14.29	1 7.14			2 14.29						8.50	45.75
11	F178								1 7.14	3 21.43	2 14.29	2 14.29	1 7.14	1 7.14	2 14.29	1 7.14	1 7.14						10.50	50.00
12	H169									3 14.29	1 7.14	4 28.57	1 7.14	1 7.14	2 14.29			3 21.43					10.50	55.10
13	I41									1 7.14		3 21.43	3 21.43	3 21.43	1 7.14	1 7.14	1 7.14	1 7.14					11.50	56.05
14	E161									1 7.14	2 14.29	3 21.43	1 7.14	1 7.14		2 14.29		4 28.57					11.50	58.16
15	G43									2 14.29				2 14.29		2 14.29	3 14.29	1 7.14	3 21.43	2 14.29			15.00	68.36
16	H5										3 21.43			1 7.14	2 14.29			1 7.14	5 35.71		2 14.29		16.50	69.38
17	E91														2 14.29	2 14.29	2 14.29	2 14.29	9 28.57	1 7.14		1 7.14	16.50	75.51
18	I65														1 7.14	3 14.29	3 21.43	1 7.14		4 28.57	2 14.29		15.50	76.88
19	F153													1 7.14	1 7.14	1 7.14	1 7.14		2 14.29	4 28.57	2 14.29	2 14.29	18.25	88.96
20	L10														2 14.29	1 7.14	2 14.29	1 7.14			5 35.71	3 21.43	18.20	87.97
21	H150																			3 21.43	3 21.43	5 57.14	20.13	92.17

Table to be read as VIa. Array of samples according to per cent rank instead of median rank.

distribution and the array of the medians of the "legend distributions" (Tables IVa, b, c, and d) offers a somewhat mutual check on the validity of the two methods. Pearson's "Method Adapted to Rank Difference" was used. The formula, in which r is the degree of correlation, is $R = 1 - \frac{6S\ (D^2)}{N\ (n^2-1)}$. The computations showed the r of the two methods for house samples to be .99, for figure in action to be .95, for rabbit samples to be .98, and for tree samples to be .96.

TABLE VIe

SHOWING COMPARISON OF SERIAL AND 'LEGEND DISTRIBUTION' OF HOUSE SAMPLES

Samples	Serial dist. per cent rank array	Legend dist.	Differences in rank +	Differences in rank −	D	S(D²)
A60	1	1			0	0
B1	2	2			0	0
A17	3	3			0	0
B131	4	4			0	0
B162	5	5			0	0
D59	6	6			0	0
D64	7	7			0	0
H89	8	8			0	0
G92	9	9			0	0
K53	10	11	1			1
H69	11	10		1		1
H120	12	13	1			1
J62	13	14	1			1
H106	14	12		2		4
J59	15	17	2			4
K46	16	15		1		1
J3	17	16		1		1
J109	18	18		0		0
K75	19	19		0		0
K89	20	20		0		0
L200	21	21		0		0
Totals ..			5	−5		14

$$p = 1 - \frac{6 \times 14}{9240} = .99, \text{ whence } r = .99$$

In the serial distribution it was found that the position of the medians in array did not in all instances conform with that of the per cent rank. This occurred in two samples in Table VId. The array of per cent rank is allowed to prevail, since it forms the basis of the final array of the samples in the scale.

IV. ARRANGING SAMPLES IN THE SCALE

1. Probable Error Taken as Unit of Measure Between Medians

The rank given a sample by the judges depended of course upon the degree of its qualities in relation to those of all the other samples. It was a rank based upon merit. An inspection of Tables VIa, b, c, and d shows that judgments of merit of a sample tended, with but minor exceptions, to greater frequencies about the median rank, and to grow less and less above and below that point. The effect of such a spread in the distribution of the judgments produced overlapping, so-called, of merit between adjacent and near-adjacent samples in the median array, so that a certain per cent of the judgments of a lower sample might extend beyond one or more medians of higher samples, while still other per cent of judgments of the same sample might reach below the median or medians of lower samples. Advantage is often taken of this form of distribution in scale construction to measure the distance between medians of adjacent samples or groups. To do so implies the necessity of assuming that judgments of merit or of rank conform to a normal surface of distribution and that distances on either side of the median line of such a surface may be measured off on its base line in terms of the median deviation or probable error.

The P. E. thus becomes the unit (perhaps the best available at present) for measuring distances between adjacent medians of groups in serial distribution.

Attention is here directed to those properties of the P. E. that make such applications possible. Fig. VI shows a normal surface of frequency. The line *dM* is drawn perpendicular to the base of the distribution surface so that 50 per cent of all judgments lie on one side of *dM*, and 50 per cent on the other side. The point where the perpendicular cuts the base is the median point. The perpendicular line *e* is so drawn to the right of the median point that just 25 per cent

of the judgments lie between it and the median *dM*. A similar perpendicular *cb* is drawn to the left of the median. The area *cbcf*, cut off by these perpendiculars, contains the middle 50 per cent of all judgments. The distance *bM* or *fM* on the base line *xy* is the Probable Error; i. e., a distance along the base line of a normal frequency surface from the median point to the perpendicular on either side of the median which cuts off 25 per cent of the cases, is P. E. It has also

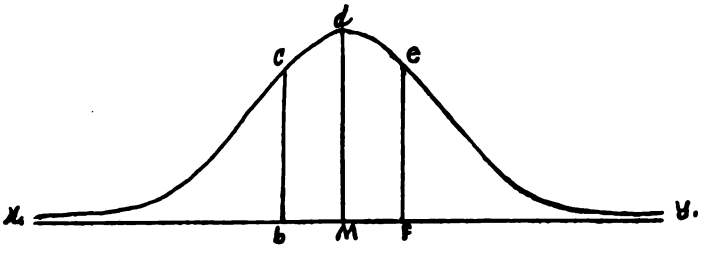


FIG. VI.—Normal surface of distribution showing the Median and P. E. distance at each side of the Median Point.

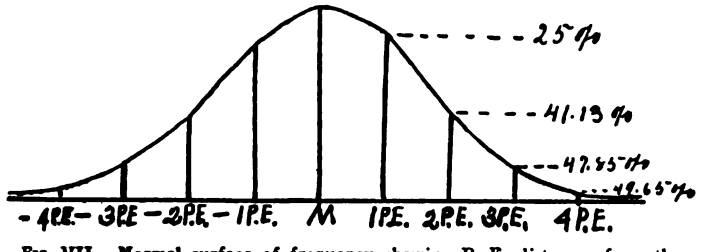


FIG. VII.—Normal surface of frequency showing P. E. distances from the Median Point.

been found that if a perpendicular be erected at a distance of two P. E. on the base line of the surface of frequency, and on either side of the median point, it will include with the median perpendicular 41.13 per cent of all the judgments; if erected at a distance of three P. E. it will include 47.85 per cent of the judgments; and if erected at a distance of four P. E. it will include 49.65 per cent of the judgments. Fig. VII shows the conditions in a graphic way. In the present investigation P. E. values above 3.6 were not needed.

But since units of P. E. represent so many per cent of 50 per cent of judgments it follows that, if the per cent of judgments above or below the median be known, the corresponding P. E. distances can be determined. Let it be required to compute the distance between the median d^1m^1 and $d^{11}m^{11}$ on the base line xy in Fig. VIII, assuming of course that the per cents at which the two frequency surfaces mutually overlap are known. The area included by the lines $sm^{11}n$ bounded by the dotted lines is 15.48 per cent of the area included within the lines d^1m^1n. Whence the per cent included within the area $d^1m^1m^{11}s$ is $50-15.48$, or 34.52 per cent. The P. E. equivalent of 34.52 per cent is 1.507. Also the area included by the lines rm^1p of the frequency surface bounded by the continuous lines is 84.25 per cent of the entire frequency surface, since the per cent included within the area $d^{11}m^{11}rm^1$ is $84.25-50$, or 34.25 per cent. The P. E. equivalent of 34.25 per cent is 1.490. Two measures, then, have been found for the distances m^1m^{11} on the base line xy. The average $\frac{1.507+1.490}{2}$, or 1.4985 P. E., is nearer the exact measure. To apply these processes of computation to determining the distances between the median judgments of each of the 21 samples it was only necessary to arrange the medians in an array, together with the frequency distribution of each sample. These are shown in Tables VIa, b, c, and d, also the per cents of the frequencies within a distribution. Table VII was derived from basic Table VIa. To aid in interpreting the directions for reading these tables, a computation of one distance is here inserted. Let it be required to determine the distance in P. E. units between the median 6.66 of sample *D64* and median 7.67 of sample *H89* of Table VIa. Observe that four (arrived at by interpolation) of the 14 judgments of samples *D64* were equal to or beyond the median 7.67 of sample *H89*. That is, 28.57 per cent of the judgments regarded sample *D64* equal to or better than median judgment of sample *H89*. Hence, 50 per cent minus 28.57 per cent, or 21.43 per cent, makes the upper extension of sample *D64* value—judgments that coin-

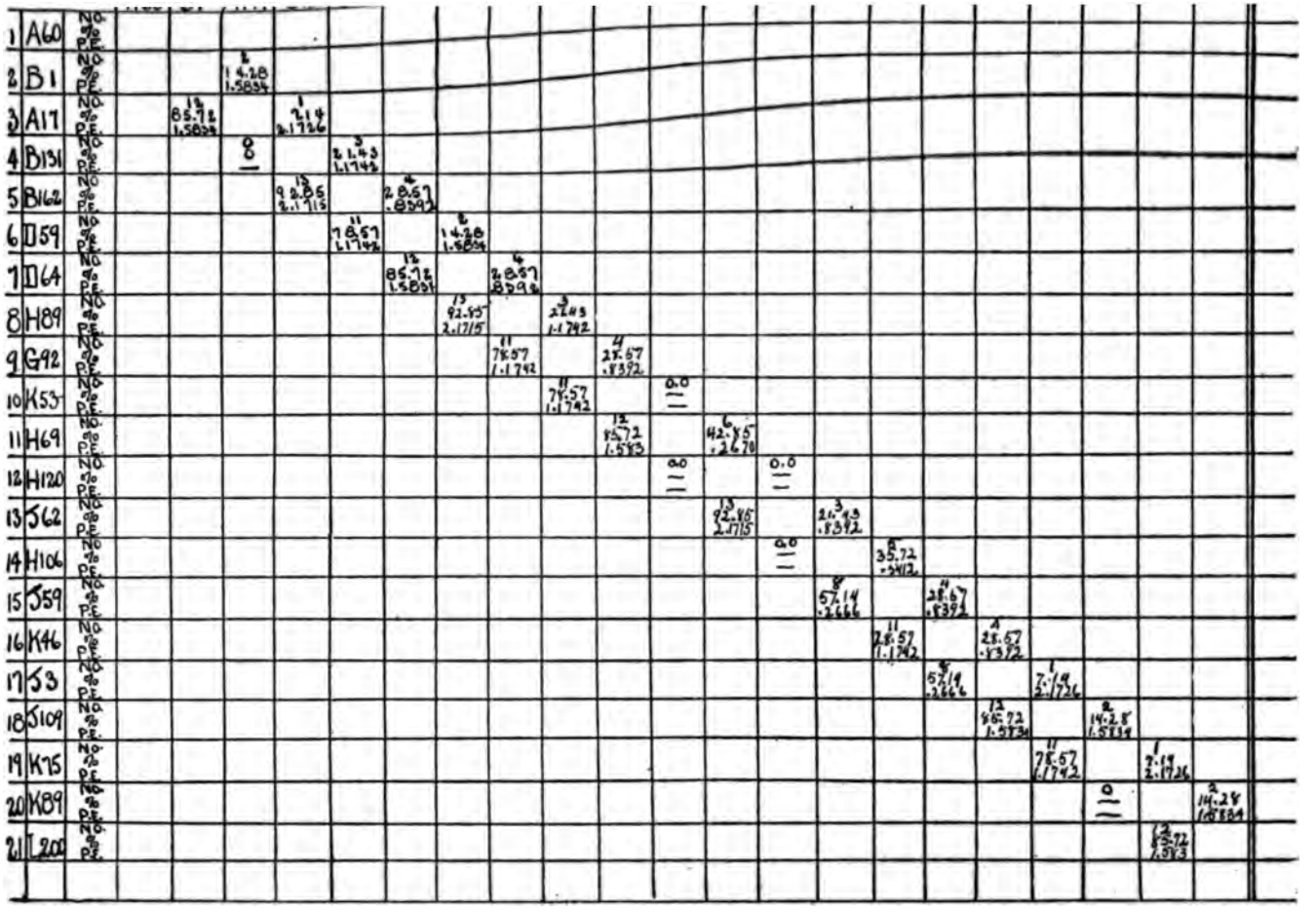


Table to be read: 2 judgments of Sample B1 extended beyond the median of Sample A17 but two is 14.28% of 14. The P. E. value of difference between 50 per cent and per cent (14.28%) of overlapping is 1.5834. 12 or 85.72% of 14 judgments were above the median (Table VIa) of Sample B1, the P. E. equivalent of difference between 50% and 85.72 is 1.5834. Whence P. E. value or distance between medians of Samples

cide with median judgments of sample *H89*. The P. E. equivalent of 21.43 per cent is .8392. Moreover, one judgment in sample *H89* distribution extends to or below the median 6.66 of *D64*. Hence, 13−7, or 92.85 per cent minus 50 per cent, or 42.85 per cent, equals the distribution of judgments in the

TABLE VIII

SHOWING P. E. EQUIVALENT OF DIFFERENCE BETWEEN 50 PER CENT AND PER CENT OF OVERLAPPING JUDGMENTS FOR ADJACENT SAMPLES: HOUSE

		P.E. Values				
		Upper	Lower	Average	Distance in P.E. above Zero Point	Scale Values
1	A68					0
2	B1				1.0000	1
3	A17	1.5834	1.5834	1.5834	2.5834	3
4	B1B1	0.0000	2.1726	2.1726	4.7560	5
5	B1C2	2.1715	1.1792	1.6798	6.4308	6
6	D59	1.1792	0.8392	1.0067	7.4375	7
7	D64	1.5834	1.5834	1.5834	9.0209	9
8	H39	2.1715	0.8392	1.5053	10.5272	10
9	B42	1.1792	1.1792	1.1792	11.7064	12
10	K53	1.1792	0.8392	1.0067	12.7087	13
11	H69	1.5834	0.0000	1.5834	14.2918	14
12	H00	0.0000	0.2670	0.2670	14.5588	15
13	J62	2.1715	0.0000	2.1715	16.7300	16
14	H06	0.0000	0.8392	0.8392	17.5692	17
15	J59	0.2646	0.5412	0.4029	17.9721	18
16	K41	1.1792	0.8392	1.0067	18.9788	19
17	J3	0.2646	0.8392	0.5529	19.5317	20
18	J109	1.5834	2.1726	1.8778	21.4095	21
19	K75	1.1792	1.6834	1.4313	22.8408	23
20	K99	0.0000	2.1792	2.1735	24.9144	25
21	L209	1.5834	1.6834	1.6834	26.5978	27

This Table is derived from Table VII. Upper P. E. values refer to judgments of higher sample that extended to or below adjacent median of lower sample; lower P. E. values refer to judgments of lower samples that extend to or above adjacent higher median.

minus half of sample *H89*. The P. E. equivalent of 42.85 is 2.1715. The average of .8392+2.1715 is 1.5053, which is the distance in P. E. units between the samples in question. Tables VII and VIII show all the computations for the serial distribution of house samples. The fifth column of Table VIII shows the average of P. E. values of each interval between the medians. The summation of these averages is presented

in the sixth column and shows the distance of each sample above zero, as well as the distance between individual samples.

The distance from the zero sample *A6o* to sample *B1* is arbitrarily [1] taken as 1 P. E. The seventh column shows the final scale values obtained by discarding all figures to the right of the decimal. This has produced remarkably uniform scale values for the house samples concerned. The results of this form of distribution appear to back up in every instance those obtained under the control 'legend.' The scale values as computed by the overlapping method for the remaining three themes appear in the eighth column of Tables IXb, c, d. These values, despite the higher correlation between the serial and legend distribution, rest upon a number of minor variations that cast some doubt upon their validity and led us to reject their use on the scale samples. Some of the variations could have been prevented if the conditions causing them had been foreseen in time; e. g., a larger number of judges would doubtless have smoothed out some of the irregularities; others inhere in the nature of the work itself.

A full discussion of all the facts would contribute but little to the scale, but the more serious ones are given in order to make clear the reasons for substituting the per cent method for that of overlapping in scaling the distances between the samples. Table VIb shows that the highest values assigned to sample *C23* does not reach the lowest value given to sample *F57*, the next in the median array. Such a condition prevents the direct use of the overlapping method. An inspection of Tables VIc and d shows that the same conditions occur between the second and third samples of figure in action and

[1] No way has as yet been devised for measuring satisfactorily the actual distance in such cases. There is no general agreement as to the nature of the facts upon which such measurement must be computed. The psychologists might be satisfied with some method that would register the growth and coordinations of the psychophysical processes involved in the transition from infantile scribbling to the first meaningful effort. We have preferred to allow the *intention of meaning* as an observable fact to register the difference; but as that is not a numerical measure of the distance we are forced to make an arbitrary assumption.

of tree. We are persuaded that such conditions are due to an over-elimination in reducing the 63 samples to 21. The differences between the samples at the lower limits of the scale appear to be too great by this method. Only use can show whether or not that is a practical defect.

Figure VIII illustrates the absence of overlapping of medians in the case of the frequency surface *qdt*. Several pairs of medians of serial distribution have zero differences, e. g., rabbit samples, Table VIb, have two pairs of similar medians (*H97—H53* and *H51—I29*); figure in action samples, Table VIc, have two pairs (*L5—J14* and *I58—K3*); and

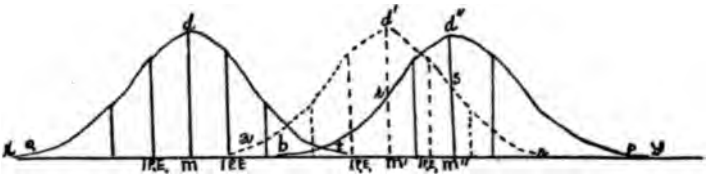


FIG. VIII.—Normal surface of frequencies whose median points are adjacent in array of median values increasing from left to right. No part of surface *qdt* overlaps median of adjacent surfaces. But surfaces *ad'r* and *bd''p* mutually overlap their medians.

tree samples, Table VId, have four pairs of similar medians. Only two samples, Table VIc, show similar ranking by the per cent method.

It is not urged here that the adoption of the per cent method has removed the minor difficulties and inconsistencies encountered in the use of the 'overlapping' judgments, but rather that it obviates the necessity of dealing with them.

The per cent method, like that of overlapping, measures the distance between scale values by means of P. E. units as derived from a normal frequency distribution. Its application in the present instance is based upon the assumption that the achievements in drawings as represented by the values found in the 21 samples are distributed according to a normal frequency surface; that the samples, owing to the manner of selection, show the range typical of drawing achievements as now done by the entire public school groups. It follows that if drawings of such groups be distributed according to

these values by far the largest number would fall on and near the values occupying the median position between the poorest and the best, and that the number of frequencies would become less and less as distances increase plus and minus from the median value. To return to the 21 samples, if now the per cent rank of each of the 21 be ascertained and the respective distances above and below the 50 per cent rank be known it is possible to determine in P. E. units the distance from the median or 50 per cent and from these values one may construct in turn a scale in linear projection beginning with zero value. The arithmetical computation is simple enough; the base upon which the per cents are reckoned is the number of assignable positions times the number of judges; for example, in case of house samples the base is 21 times 14, or 294. The absolute rank of a sample is the sum of the products of the respective serial numbers times the judgment frequencies. The per cent rank then of a sample is derived from its base and its absolute rank.

Tables VIa, b, c, and d show these ranks in the last column to the right and from this column Tables IXa, b, c, and d were constructed. A brief description of these tables will indicate the steps involved in determining the final scale values. The fourth column shows the difference between 50 per cent and the per cent of rank of each sample. The value is minus if the rank is less than 50 and plus when it is more. The P. E.[1] equivalent of these plus and minus values is shown in column five. The zero sample in each theme is arbitrarily set 1 P. E. below the P. E. value of the next sample. Thus the P. E. value of *A6o,* house sample, Table IXa, is set at minus 3.3195 below the median for the reason that sample *B1* just above has P. E. minus 2.3195.[2] Locating the dis-

[1] P. E. is computed from Table 48 in "Spelling Ability" by B. R. Buckingham, a variation of Table 44, page 198, of Thorndike's "Mental and Social Measurements."

[2] A clear exposition of this method may be found in a monograph by Henry Gustav Hotz, "First Year Algebra Scales," Teachers' College, Columbia University, 1918. See also, "A Scale for Measuring Pupils' Ability to Demonstrate Geometrical Theorems" by J. K. Minnick, School Review, February, 1919.

TABLE IXa

Showing Per Cent of Rank to Total Possible Rank Difference Between 50 Per Cent and Per Cent Rank, P. E. Equivalent of Per Cent: House, 14 Judges

No	Name of Sample	Per Cent Rank of Sample	Difference between 50% and Per Cent Rank of Sample	P.E. Equivalent of Difference between 50% and Per Cent Rank	Distance of P.E. above Zero Point	Scale Value of Sample
1	A60'			-3.5195	0	0
2	B1'	5.77	-44.23	-2.3195	1.200	10
3	A17'	8.84	-41.16	-2.0030	1.316	13
4	B131'	16.35	-33.67	-1.4542	1.865	18
5	B162'	21.08	-28.92	-1.1920	2.127	21
6	D57'	22.45	-27.55	-1.0736	2.246	22
7	D69'	28.59	-20.41	-.7959	2.523	25
8	H89'	34.35	-15.65	-.5880	2.731	27
9	G92'	35.71	-14.29	-.5426	2.776	28
10	K53'	42.17	-7.83	-.2932	3.026	—1
11	H69'	48.64	-1.36	-.0509	3.269	32
12	H120'	50.34	+0.34	+.0126	3.332	33
13	J62'	62.04	12.04	.4646	3.774	37
14	H106'	63.00	13.00	.4920	3.815	38
15	J69'	66.35	16.33	.6262	3.944	39
16	K46'	72.10	22.10	.8490	4.158	41
17	J3'	74.50	24.50	.9770	4.296	43
18	J109'	80.95	30.95	1.2990	4.618	46
19	K75'	84.01	34.01	1.4761	4.795	48
20	K89'	91.15	41.15	2.0020	5.321	53
21	L200'	93.20	43.20	2.3110	5.530	55

Read the table as follows: 14 judges in serial ranking placed Sample A60 at zero (0), Sample B1 at 5.77% of distance from 0 to 100, Sample A17 was assigned 8.84% of the distance. [294, 14 × 21 is taken as base and the sum of products of number of judgments by their rank is the per cent, e. g., A17 was placed at 1, 3 times, at 2, 10 times, and at 3, 1 time (Table VIIa), giving a total of 26; whence per cent rank = 26 × 100 ÷ 294 = 8.84%.] Sample A60 is arbitrarily assigned per cent rank — 48.75 giving P. E. — 3.3195 approximately. Sample B1 then becomes 1 P. E. Final scale values are obtained by moving the decimal point in column VI one place to the right. 1 sample does not appear in the scale.

TABLE IXb

Showing Per Cent of Rank to Total Possible Rank, Difference Between 50 Per Cent and Per Cent Rank, P. E. Equivalent of Per Cent: Rabbit, 12 Judges

No.	Name of Sample	Per Cent Rank of Sample	Difference between 50% and Per Cent Rank of Sample	P.E. Equivalent of Difference between 50% and Per Cent Rank of Sample	Distance of P.E. above Zero Point	Scale Value of Sample	Scale Value according to Thurstone method
1	B27*	0.79	-49.21	-3.597	0	0	0
2	C23*	3.96	-46.04	-2.597	1.000	10	1
3	E57*	11.11	-38.89	-1.810	1.787	18	2
4	E73*	16.27	-33.73	-1.458	2.139	21	3
5	E63*	21.42	-28.58	-1.175	2.418	24	4
6	D57*	24.20	-25.80	-1.038	2.559	25	4.6
7	E60*	27.38	-22.62	-.892	2.705	27	5.4
8	E48*	34.53	-15.48	-.591	3.006	30	7
9	D63*	40.07	-9.93	-.375	3.222	32	9
10	H97*	42.96	-7.54	-.262	3.335	33	10
11	H63*	44.84	-5.96	-.222	3.375	—†	—
12	H60*	50.96	+0.96	+.162	3.759	37	12
13	J98*	53.73	3.73	.327	3.924	39	13
14	J67*	62.62	12.62	.477	4.074	40	14
15	H45*	68.86	18.86	.739	4.336	—	—
16	H51*	72.22	22.22	.879	4.476	44	15
17	J39*	71.03	21.03	.821	4.418	—	—
18	J24*	80.15	30.15	1.256	4.853	48	18
19	J9*	81.34	31.34	1.320	4.917	49	19
20	H107*	90.47	40.47	1.941	5.538	55	21
21	K10*	94.84	44.84	2.417	6.014	60	22

Read as Table IXa.

* The P. E. of Sample B27 is — 3.578 instead of —3.597. The latter value is preferred in order to make 1st step above zero equal 1.

† Samples do not appear in scale. See text.

TABLE IXc

SHOWING PER CENT OF RANK TO TOTAL POSSIBLE RANK, DIFFERENCE BETWEEN 50 PER CENT AND PER CENT RANK, P. E. EQUIVALENT OF DIFFERENCE: FIGURE IN ACTION, 12 JUDGES

No	Name of Sample	Per Cent Rank of Sample	Difference between 50 and Per Cent Rank of Sample	P.E. Equivalent of Difference between 50 and Per Cent Rank of Sample	Distance of P.E. above Zero Point	Scale Value of Sample	Scale Values by Overlapping Method
1	A5[3]			-3.474*	.0	0	0
2	B69[3]	4.76	-45.24	-2.474	1.000	10	1
3	B86[3]	12.70	-37.30	-1.692	1.782	18	2
4	D42[3]	14.68	-35.32	-1.557	1.917	19	3
5	C119[3]	22.61	-27.39	-1.114	2.360	24	4
6	E79[3]	27.38	-22.62	-.891	2.583	—†	—
7	D98[3]	34.12	-15.88	-.607	2.867	28	6
8	C150[3]	34.12	-15.88	-.557	2.867	—	—
9	B115[3]	35.31	-14.69	-.558	2.916	29	5.6
10	C93[3]	39.28	-10.72	-.409	3.070	30	7
11	D104[3]	41.66	-8.34	-.312	3.162	32	7.2
12	K37[3]	53.38	+3.38	+.018	3.562	35	8.8
13	L116[3]	55.15	5.15	.192	3.666	—	9.2
14	J8[3]	63.49	13.49	.511	3.985	40	11
15	L5[3]	71.03	21.03	.821	4.295	42	12
16	J14[3]	74.82	24.82	.956	4.330	—	12
17	I5[3]	72.38	27.38	1.114	4.658	45	13
18	I68[3]	71.74	31.74	1.342	4.816	48	14
19	K3[3]	32.63	32.63	1.387	4.861	—	14
20	K2[3]	84.12	34.12	1.492	4.956	50	15
21	J18[3]	93.65	43.65	2.263	5.727	57	17

* The P. E. — 3.474 is taken arbitrarily.
† Samples do not appear in scale.

TABLE IXd

SHOWING PER CENT OF RANK TO TOTAL POSSIBLE RANK, DIFFERENCE BETWEEN 50 PER CENT AND PER CENT RANK, P. E. EQUIVALENT OF DIFFERENCE: TREE, 14 JUDGES

No	Name of Sample	Percent Rank of Sample	Difference between 50% and Percent Rank of Sample	P.E. Equivalent of difference between 50 and Percent Rank of Sample	Distance of P.E. Above Zero Point	Scale value of Sample.	Scale Values by overlapping method.
1	B10			-3.474	0	0	0
2	D22	4.76	-45.24	-2.474	[illegible]	10	1
3	F4	11.56	-38.44	-1.775	1.699	16	2
4	E16	15.98	-34.02	-1.476	1.998	19	3
5	C184	17.00	-33.00	-1.415	2.059	20	4
6	G55	29.93	-20.07	-.780	2.694	26	43
7	F124	31.63	-18.37	-.768	2.706	27	5
8	H176	37.41	-12.59	-.476	2.999	30	52
9	H173	38.09	-11.91	-.449	3.025	—	—
10	E67	45.75	-4.25	-.158	3.316	—	—
11	F178	50.00	.00	.000	3.474	34	6.7
12	H169	55.10	+5.10	+.190	3.664	36	6.7
13	F61	56.05	6.05	.226	3.700	37	7.5
14	E141	58.16	8.16	.305	3.779	38	7.5
15	G43	68.36	18.36	.708	4.182	41	8.7
16	I15	69.38	19.38	.751	4.225	42	9
17	E91	75.51	25.51	1.024	4.498	44	9
18	I65	76.88	26.88	1.090	4.564	45	8.7
19	F155	80.95	30.95	1.299	4.773	47	10
20	L10	81.97	31.97	1.355	4.829	48	11
21	H180	92.17	42.17	2.100	5.574	55	12

* Samples G43 and I65 have same medians, but are separated here owing to difference in per cent rank.
† The distance above zero by 'overlapping' method is relatively small owing to the many similar medians from serial distribution.

tances of the remaining samples consisted in subtracting the minus P. E. values from that of zero sample and in adding the respective P. E. values. The results as shown in column six were converted into final values by moving the decimal one place to the right and counting the decimal to the nearest whole as an integer. These values appear on, and, of course, determine the order of, the samples in the sale.

2. Basis for Futher Elimination of Samples

Although the serial distribution contained 21 samples the number finally assigned to each scale was slightly less in each case. The number stands: house, 20 samples; tree, 19 samples; rabbit, 18 samples; and figure in action, 16 samples. The bases for elimination were in general two: if the ratings on two drawings gave identical medians the less serviceable for the step in question might be dropped; or again, if a sample duplicated the significant features of the two samples on either side and added nothing new on its own account, or was significantly lacking in features better expressed by adjacent samples for that step, it was omitted; or again, if there was a reversal of the median array by the per cent rank such a condition was regarded as ground for rejecting one or both samples. Tables IXc, sample *D98*, and Table IXd, sample *I65*, show one reversal each. But if such a sample added some significant feature and was backed up by the legend distribution it might be retained; this applies to the tree sample *I65*.

From the house series samples *K53*, serial score 9.4, scale value 30, was omitted because it failed to express proportion of parts and ability for handling typical drawing principles for this section of the scale, better expressed by adjacent and other samples.

From the rabbit series three samples were omitted: *H63*, serial median 9.5, because its median was identical with that of *H97*, and unlike the latter it failed to express proportion and due relation of parts typical at that step of the scale. All the pertinent characteristics of *H45* were duplicated by

J47. The serial and 'legend medians' of *I29* duplicated both of those of *H51*.

From the figure in action series five samples were dropped for the reason that their places were equally represented by an adjacent sample either above or below. Their presence contributed no new feature to the scale. An inspection of Table VIc shows that some of these duplicated the medians of adjacent samples and one sample, *C150*, has the same per cent rank as an adjacent sample, but lacked features characteristic of this section of the scale. Only two samples were dropped from the tree series, despite the fact of many duplicate medians. The per cent rank of the trees presents no duplications, and besides the samples having similar medians are all different species of tree and on that account, while not adding anything decidedly significant to the scale, show a different sort of achievement.

Before leaving this section of the scale attention is directed to the fact that each sample won its place, as it were, by a series of competitive tests, the conditions of which it will be observed were kept objective as far as possible. In general, three methods have been applied: (1) A rough 'type-median-75 per cent-agreement' plan. (2) Use of the legend in controlling distribution of 63 samples. (3) The serial plan. The statistical pedigree of any sample may be traced by inspecting in succession the following tables: IV, VI, and IX. Figure IX shows a comparative view of linear projections of the scales of each of the four themes. The linear projections of house and rabbit scales show more uniform distances between scale units.

3. Analytical Description of the Samples

The description of the samples is pedagogical in its aims, intended to aid teachers and pupils in the use of the scales.

The descriptive matter appears under the scale pictures to be found at the end of the study.

This function of scales is sometimes questioned and, perhaps, properly so for some scales, but no sufficient reason appears for limiting drawing scales to merely measuring results.

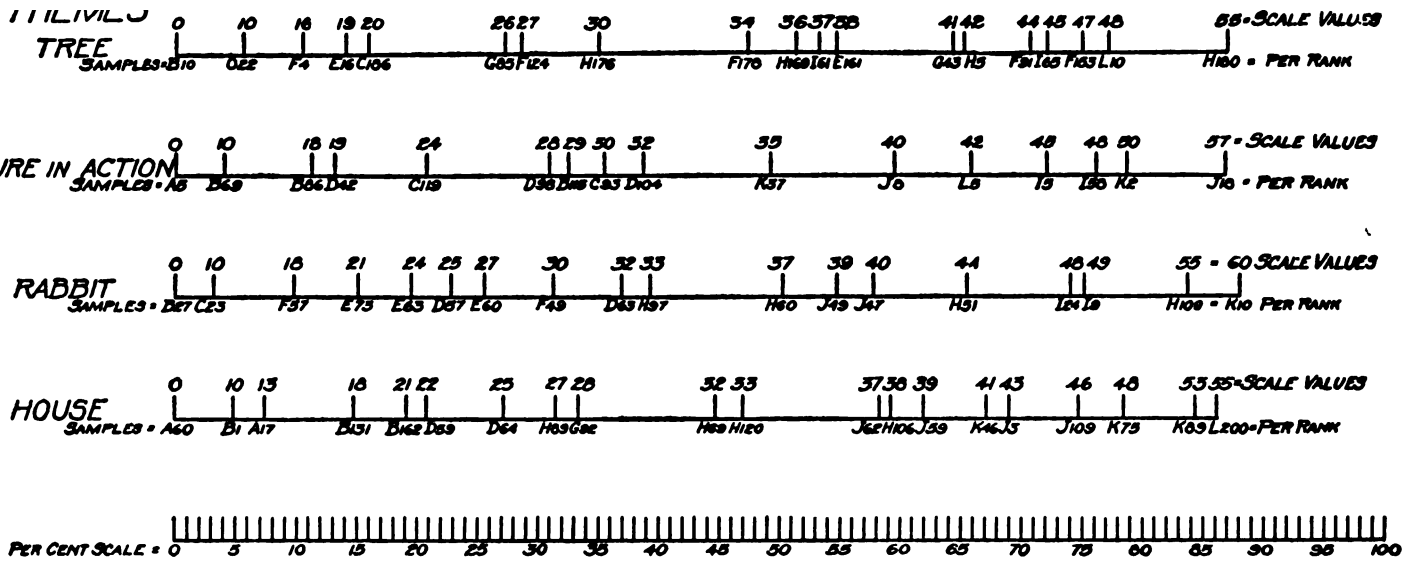


FIG. IX.—Showing line projection of per cent rank of samples and corresponding scale values as based upon P. E. Equivalents. [Per cent rank values given in Table IX.] Note: Samples of different themes having same scale value but different rank in per cent will not occupy similar points in linear projection.

4. Directions for Using Scale

A. DIRECTIONS TO PUPILS

Turn to the theme on the scale folder that is similar to your drawing. Move your drawing along the scale until a sample is found that appears to match it. Read the description of the sample given below and see if it describes your own drawing as well. If the description does not apply so well to your drawing, read that of the sample next below in the scale and also compare your drawing with the scale samples. Now, if your drawing matches the sample and fits the description, write on your drawing the number in the scale. But, if the second sample and its description is not so good as the first, go to the sample and description that is just above the first that you used, and make a similar comparison and if this is more satisfactory than either of the other two, give to your drawing the score similar to the number on the sample. This number is the score of your drawing.

If you wish to get your standing for drawing in representation, as it is called, make four drawings from memory; a house or any other kind of building, a rabbit or squirrel, a tree, and a boy running. Then grade each according to the directions given above and find the average of the four grades. The average scale value that is nearest is your standing in drawing as measured by the scale.

B. DIRECTIONS TO TEACHERS

To score a drawing compare it at least with three drawings of the scale in the manner of the directions given to the pupils. To ascertain the standing of a class: (1) Classify the drawings according to themes. (2) Place the scale folder on blackboard molding or other support. (3) Score all drawings of the same theme before passing to those of another and record the scores in the blank space provided in the score sheet as given in the text. (4) Compute the median and average for each theme separately. (5) Average the medians for the different themes thus scored. The scale

numbers nearest to the average of the medians is the class standing for drawings done in representation.

A form of the score sheet is given here, and in it are shown the scores of 20 drawings of houses done by the 7th grade and 20 drawings of trees done by the 5th grade. The median score for the house drawings of the class is 26, which is nearest to scale value 25 written on sample *D64*. This scale sample thus becomes the measure of the 7th grade drawings of houses. The median score of the 5th grade drawings of trees is 20, which is the same as the scale value of sample *C186*. This sample then becomes the measure for the tree drawings of the 5th grade. The same drawings were scored to the scale by two other judges. The scores of the three judges are given here.

	House		Tree	
Judges	Average	Median	Average	Median
1	27	26.5	21	20.5
2	28.75	28.00	29	28
3	28	27	27.50	27

5. Desirability of Standardizing the Scale

"To the teacher of artistic temperament who objects that accurate grading of work in drawing is impossible, that much work is dependent upon sentiment, is intangible, and should be left unmeasured so far as the pupil is concerned, the answer is that measurement in drawing is constantly being made through 'grades' or 'marks' which are given to children." This quotation from Wilson and Hoke "How to Measure," written in the interest of measuring school art according to scales applies with equal force to standardizing the achievements of public school drawing. It is doubtless true that we have acquiesced all too long in the notion that the products of drawing were due to more or less mysterious gifts independent of methodical instruction and painstaking effort. When it is once realized that drawing talent, so-called, shares in equality of distribution with the gifts involved in the mastery of the other common branches, and that higher products of art are made possible by the mastery of its funda-

TABLE FOR SCORE SHEETS

Score Sheet for Class in Drawing

TEACHER'S RECORD

Town or City..... School.....

Grade..... Date.....

Pupils' names	Score for drawings: House	Rabbit	Figure in action	Tree	Average
1	22	...	...	26	...
2	27	...	...	26	...
3	22	...	...	20	...
4	27	...	...	20	...
5	25	...	...	30	...
6	27	...	..	20	...
7	27	...	...	26	...
8	27	...	...	16	...
9	25	...	...	26	...
10	27	...	...	10	...
11	18	...	...	20	...
12	28	...	...	20	...
13	27	...	...	19	...
14	22	...	...	20	...
15	22	...	...	19	...
16	21	...	...	20	...
17	13	...	...	20	...
18	33	...	...	10	...
19	27	...	...	10	...
20	22	...	...	10	...
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	..	...	...	..	...
	..	...	...	..	...
Average	24.4	...	...	19.5	...
Median score	..	...	...	..	...
Median of averages	..	...	...	..	...

Score Sheet for Class in Drawing

[DUPLICATE]

Tear on dotted line and return to authors

Town or City..... School.....

Grade..... Date.....

Pupils' names	Score for drawings: House	Rabbit	Figure in action	Tree	Average
1	22	...	...	26	...
2	27	...	...	26	...
3	22	...	...	20	...
4	27	...	...	20	...
5	25	...	...	30	...
6	27	...	...	20	...
7	27	...	...	26	...
8	27	...	...	19	...
9	25	...	...	26	...
10	27	...	...	10	...
11	18	...	...	20	...
12	28	...	...	20	...
13	27	...	...	19	...
14	22	...	...	20	...
15	22	...	...	19	...
16	21	...	...	20	...
17	13	...	...	20	...
18	33	...	...	10	...
19	27	...	...	10	...
20	22	...	...	10	...
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	..	...	...	..	...
Average	24.4	...	...	19.5	...
Median score	25	...	...	26	...
Median of averages	..	...	...	..	...

Send drawings with scores to—
L. W. KLINE, Saratoga Springs, N. Y.,
or to
GERTRUDE L. CAREY, Duluth, Minn.

mental technique and by reducing to habit and to 'graphic language' the fundamental art norms, the desirability of having reliable standards and norms becomes apparent.

Teachers of art in Public and private schools are earnestly asked to co-operate with the authors in this work of standardizing the present scale by forwarding to them drawings done from *memory* in their school rooms. It is highly desirable that teachers use the form of score sheet shown above, and send both their own ratings, and the drawings.

V. GENERAL ASPECTS OF TEACHING DRAWING

Inasmuch as children begin to use drawing to express ideas almost as early as the spoken language, we are justified in assuming that the native equipment for drawing is at least equal to that for any other subject, and that approximately the same progress can be expected in drawing as in other subjects under similar instruction.

Imitation is strong in childhood and continues through adult life. During the first few years of the child's life, practically everything is secured through imitation. Some educators object to imitation when it comes to drawing, on the ground that it interferes with free expression. On the other hand, should it not be an aid to free expression by putting the tools in the hands of the child?

In too many schools the child's progress is measured by what he can say, disregarding entirely what he is able to tell with his hands. "I can't tell it, but I can show you how it looks and how it is done," is too often the answer to questions put to children, to be disregarded. This ability to show the construction of animals, plants and objects, and to illustrate processes through graphic representation is too valuable an achievement to be ignored and bears a very direct relationship to constructive work. This view is strongly reinforced by the claim of engineers and by teachers of botany, zoology, geology and all technical subjects. In fact, it is the most natural and most accurate means of description, in all subjects where a clear idea of structure and relation of parts is necessary.

Teachers should keep in mind the fact that the house, the rabbit, the boy running, and the tree, are but types, and when teaching these type-forms other forms based upon the principles involved should be studied at the same time, e. g., when working upon the house, children should draw boxes, street cars, milk wagons, trucks, tables, or other objects involving the elementary principles of construction and perspective.

While learning to draw a rabbit, draw a squirrel, a dog, a horse, or other animals, noting differences and likenesses. The cultivation of the ability to compare and evaluate cannot be over-emphasized. It leads to discrimination and discrimination is the basis of appreciation. We wish also to emphasize the point that the representation phase of the scale is to be used largely as it supplements and contributes to design, composition, and color. Representation is not to be interpreted as meaning an exact reproduction of all the facts of form or structure, e. g., the opportune time for drill in the drawing of the house is when the child needs to draw a house in order to tell a story, such as Red Riding Hood going to the house of her grandmother, etc. In many instances, it is impossible for the child to illustrate the stories in which he revels, unless he is able to draw fairly well the figure in action. This furnishes the incentive for drill in the illustration of such themes as The Boston Tea Party, Horatius at the Bridge, etc. The drill phase should never be emphasized at the expense of expression.

BIBLIOGRAPHY

The bibliography given here contains books and monographs consulted in the preparation of this work.

AYER, FRED C. Psychology of Drawing, 1916.

BAILEY, HENRY TURNER. Art Education, 1914.

BARNES, EARL. Studies in Education, 2d Ser., 1902, pp. 74, 151, 163, 314.

BATCHELDER, ERNEST R. Design in Theory and Practice.

BUCKINGHAM, B. R. Spelling Ability; Its Measurement and Distribution. Teachers' College.

CHAMBERLAIN, ALEXANDER. The Child: A Study in the Evolution of Man, Chap. 4, 1900.

CHILDS, H. G. The Measurement of Drawing Ability, Jour. of Educational Psychology, Vol. VI, 1915.

DOW, ARTHUR WESLEY. Theory and Practice of Teaching Art, 1913.

FREEMAN, F. M. Psychology of the Common Branches, Chap. 3, 1916.

GROOS, KARL. The Play of Man, pp. 313-322, 1901.

GROSSE, ERNEST. The Beginnings of Art, Chap. 4, 1900.

HANEY, J. P. Art Education in Public Schools, p. 167, 1908.

HILLEGAS, M. B. A Scale for the Measurement of English Composition, Teachers' College Record No. 4, 1912.

HOTZ, HENRY GUSTAVE. First Year Algebra Scales, Teachers' College Record No. 90, 1918.

LEMOS, PEDRO J. Art Simplified, 1920.

LUKENS, HERMAN T. Pedagogical Seminary, Vol. IV, 1893.

MINNICK, J. K. A Scale for Measuring Pupils' Ability to Demonstrate Geometrical Theorems, School Review, Vol. XXVII, Feb. 1919.

NORTON, DORA M. Free-Hand Perspective and Sketching.

RAYMOND, GEORGE LANSING. Genesis of Art Form.

ROSS, DENMAN. Theory of Pure Design.

RUGG, H. O. Lettering Scale, Journal of Educational Psychology, Vol. VI, 1915.

SARGENT, WALTER. Fine and Industrial Art in Elementary Education, 1912, How Children Learn to Draw.

SULLY, JAMES. Children's Ways, Chap. 12, 1902.

SULLY, JAMES. Studies in Childhood, Chap. 10, 1900.

THORNDIKE, E. L. The Measurement of Achievement in Drawing, Teachers' College Record, 1913.

WELLS, MARGARET. How the Present Came from the Past, 1918.

WILSON and HOKE. How to Measure, 1920.

WOODY, C. Measurements of some Achievements in Arithmetic, Teachers' College No. 80, 1918.

THE REVISED KLINE-CAREY MEASURING SCALE FOR FREE-HAND DRAWING

THE JOHNS HOPKINS UNIVERSITY
STUDIES IN EDUCATION
No. 5a

EDITED BY
EDWARD F. BUCHNER

THE KLINE-CAREY MEASURING SCALE
FOR
FREE-HAND DRAWING

Part I.—Representation

REVISION OF THE ORIGINAL SCALE, PUBLISHED IN THE
JOHNS HOPKINS UNIVERSITY STUDIES
IN EDUCATION No. 5

If I could make a clean sweep of everything and start afresh. . . . . I should make it absolutely necessary for everybody, for a longer or shorter period, to learn to draw.

—THOMAS H. HUXLEY.

BALTIMORE
THE JOHNS HOPKINS PRESS
1923

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KLINE-CAREY MEASURING SCALE

FOR

FREE-HAND DRAWING

REVISED

INTRODUCTION

The present form of the Kline-Carey Measuring Scale for Free-Hand Drawing is a revision and supplement to the scale as first published in the Johns Hopkins University Studies in Education, No. 5.

The original study was based upon 5214 sample drawings collected from all departments of city public schools: kindergarten, grades and high school. That number by a process of controlled selection was reduced to 73, which formed the samples of the original scale. The first scale was based on the ratings of 92 judges, the revised form on 152 judges, so that the final position of the scale samples in the revised form is fixed by the ratings of 244 judges.

The revision has been made for the following reasons:

(1) The scale values are expressed in a per cent form ranging from 0 to 85-95 and are based upon the judgments of a comparatively large number of expert judges.

(2) Both the scale folders and the printed matter accompanying the same have been arranged in a form that should make the scale readily accessible for classroom purposes.

(3) Features that were necessary for scientific exposition but that play no rôle in the practical use of the scale have been eliminated.

METHODS OF REVISION

Nearly 300 sets of picture-drawings—a set was composed of all the pictures, 73, of each of the four themes—were sent to supervisors of art in city public schools, to art teachers in colleges and in technical and in state normal schools.

The following directions were enclosed with each set of drawings:

> The drawings herewith enclosed were made from memory and deal with four themes: house (20), rabbit (18), human figure in action (16), and brush drawing of a tree (19).
>
> You are asked to rank the drawings of each theme in order of merit placing the poorest at one end and the best at the other. Make as many trials and changes as you wish until you are satisfied with the rank assigned to each specimen. No two specimens of the same theme may have the same rank. Mark 0 (zero) on the back of the poorest specimen and then indicate similarly the order in rank of the rest of the samples by using the digits 1, 2, 3, 4, 5, etc.
>
> After having ranked and marked the samples of each of the four themes, place them in the enclosed envelope and mail it at your very earliest convenience.
>
> This co-operation on your part will contribute to the work of further simplifying the use of the scale.

Attention is called to the fact that the judgments were made on the original scale pictures struck from the same plates used in printing the first edition. By this plan each judge was furnished with a fresh set—so to speak—of picture-drawings and the necessity of ranking deteriorated drawings from repeated handling was avoided, thus removing a source of error.

There were selected from the returns 152 complete sets judged by supervisors and teachers of art as described above. The four tables that follow embody the results of these judges. The symbols used for identifying the drawings in the original scale are still given in the tables to facilitate comparison between the original and the present edition.

The order of the scale samples in the tables and as they appear in the scale folders is determined by the median ranks, and the distance between any two consecutive samples is measured by units of probable error (P. E.). As the principles justifying the use of such a measure are presented at

TABLE I

Serial Ranking of Picture-Drawings

The House: 152 Judges

Number of Judges	Comparative Rank of Samples	Percents Judges	P.E. Equivalents or Difference between ranks and percent of Judges.	P.E. Distances from Zero Sample	Scale values derived from P.E. values.
	Sample A or A 50	—	—	A 0	0
152 Judges ranked	" B or B1 > A	100	—	B 3.50	15
121 " "	" C or A17 > B	79.60	1.227	C 4.73	20
142 " "	" D or B131 > C	93.42	2.236	D 6.97	30
142 " "	" E or B162 > D	93.42	2.236		
141 " "	" F or D59 > D	92.76	2.161	F 9.12	45
90 " "	" F or " > E	59.21	.345	.	
131 " "	" G or D41 > F	97.50	1.706	.	
137 " "	" H or H99 > F	90.13	1.912	H 11.04	55
82 " "	" H or " > G	53.94	.146	.	
120 " "	" I or G52 > H	78.94	1.193	I 12.23	60
128 " "	" J or H69 > I	84.92	1.297	.	
131 " "	" K or H120 > I	86.18	1.621	K 13.85	65
91 " "	" K or " > J	59.87	.370	.	
109 " "	" M or H106 > K	71.71	.871	M 14.70	70
80 " "	" N or J59 > M	52.65	.136		
98 " "	" Q or J109 > M	64.47	.549	Q 16.25	75
90 " "	" Q or " > N	59.21	.345	.	
84 " "	" L or J62 > Q	55.24	196	.	
110 " "	" P or J3 > Q	72.36	.880	P 16.13	80
91 " "	" P or " > L	59.87	.370	.	
83 " "	" O or K46 > P	54.60	.1720	.	
133 " "	" R or K75 > P	87.50	1.706	R 17.84	85
129 " "	" R or " > O	84.86	1.660	.	
105 " "	" S or K89 > R	69.08	739	S 18.58	90
114 " "	" T or L200 > S	75.00	1.000	T 19.58	95

1. Samples dropped from revised scale.
2. The P. E. value of each sample above zero is multiplied by 5 after discarding fraction to the right of decimal point. The factor 5 is obtained by dividing 95: arbitrary upper limit of scale, by the sum (19.58) of the P. E. values.
3. Table I to be read: 121 judges ranked sample *C* or *A*17 greater than,(>), sample *B* or *B*1, *i. e.*, 79.6 per cent of judges. The P. E. equivalent of 79.6—50% is 1.227. The distance from zero (0) sample *A* to sample *C*=*A* to *B*+*B* to *C*, or 3.5+1.225=4.73.
4. Both old and new symbols of identification are given to facilitate locating any sample of the present scale in the original edition.

some length in the original study and in current texts on statistical measures, there is no need for repeating the discussion here. But to facilitate the reading and the interpretation of the tables the operations involved in computing the scale values are submitted.

First: Let it be required to compute the P. E. units between the second and third samples of Table I. Of the 152 judges, 121 or 79.6 per cent[1] ranked sample C better than sample B. The difference between 79.6 per cent and 50 per cent is 29.6 per cent with a P. E. equivalent of 1.227.

Second: Be it required to compute the distance in P. E. units of sample D from A or zero sample. Since B is assumed to be 3.5 units above A, and C is computed to be 1.23 above B, and D computed to be 2.24 above C, then D is 3.5+1.23+2.24 or 6.97 P. E. units above A. The P. E. value of each sample from zero sample is similarly computed. These values appear in the column next to the last in each of the four tables.

For transmuting the P. E. values into scale values ranging from 0 to 90-95 it was only necessary to divide 95, the arbitrary upper limit of the range, by the sum of the P. E. values and then multiply each in turn by that quotient. Effort was made to find a common transmuting factor for all the four themes, but owing to the difference in the total amount of the P. E. values of the different themes it became necessary to use three factors: 5 for the house scale, 6.7 for rabbit and 6 for each of the other two themes. The P. E. values of the house samples are comparatively large, pointing to quite evident differences in merit between adjacent samples, so that their sum, when used as a divisor, gave a smaller quotient than that obtained for the rest of the themes, in which the P. E. values are relatively small, particularly in

[1] A difference in quality between two specimens great enough to produce an agreement of 75 per cent of the judges is considered sufficient for scale construction. The difference between a few of the samples in this scale show a considerably less agreement but they are retained for other reasons belonging to art rather than to statistics.

TABLE II

Serial Ranking of Picture-Drawings

THE RABBIT: 152 JUDGES

Number of Judges	Comparative Rank of Samples	Percentage Judges	P. E. Difference between Similarity of Selections of Samples and Position of Judges	P. E. Distance from Zero Sample	Scale values derived from P. E. Values
	Samples A or B?	—	—	A 0	0
107 Judges ranked	" B or C? > A	70.39	.799	B .799	5
146 " "	" C or B? > B	96.05	2.607	C 3.401	20
130 " "	" D or E? > C	85.53	1.571	D 4.972	30
101 " "	" E or D? > D	66.45	.630		
100 " "	" F or D? > D	65.13	.576	F 5.548	38
81 " "	" F or " > E'	53.29	.122		
112 " "	" G or E? > F	73.68	.939		
116 " "	" H or F? > F	76.31	1.063	H 6.611	44
82 " "	" H or " > G'	53.94	.146		
116 " "	" I or D? > H	76.31	1.063	I 7.674	50
134 " "	" J or H? > I	88.15	1.763	J 9.437	62
90 " "	" L or J? > J	59.21	.345	L 9.772	65
96 " "	" K or H? > L	63.15	.498	K 10.270	70
88 " "	" O or I? > K	57.89	.333		
112 " "	" M or J? > K	73.68	.939	M 11.209	75
87 " "	" M or " > O'	57.23	.269		
84 " "	" N or H? > M	55.26	.196		
122 " "	" P or I? > M	80.26	1.262	P 12.471	84
123 " "	" P or " > N'	80.96	.297		
90 " "	" Q or H? > P	59.21	.345	Q 12.816	86
118 " "	" R or K? > Q	77.62	1.125	R 13.941	94

1. Samples dropped from revised scale.
2. The P. E. value of each sample above zero is multiplied by 6.7. This factor is obtained by dividing 95, arbitrary upper limit of scale, by the sum (13.94) of the P. E. values. Some of the products are slightly altered, *e. g.*, 51 to 50, 93.39 to 94, etc., in the interest of simplicity. See Table IV on this point.
3. Table II to be read as Table I.

TABLE III

SERIAL RANKING OF PICTURE-DRAWINGS

THE FIGURE IN ACTION: 152 JUDGES

Number of Judges	Comparative Rank Sequences	Per cents of Judges	% Disagreement of pairs of stimuli between preceding & present orders of judges	P.E. Distance from zero Same Pal	Scale values derived from P.E. values
	Same A or A's	—	—	A .0	.0
152 Judges ranked	B or B[illegible] > A	100	—	B 3.50	20.
130 " "	D or D42 > B	85.53	1.571	D 5.87	30
95 " "	C or B8½ > D	62.50	.492	C 5.49	34
144 " "	E or C119 > C	94.73	2.401	E 7.94	48
118 " "	I or D144 > E	77.63	1.126	I 9.87	54
90 " "	G or B115 > I	59.21	.345	.	
98 " "	F or D98 > I	64.47	.549	F 9.6[illegible]	58
86 " "	F or " > G'	56.57	.245	.	
101 " "	H or C93 > F	66.45	.630	H 10.25	60
142 " "	J or K37 > H	93.42	2.236	J 12.48	75
115 " "	K or J8 > J	75.65	1.030	K 13.51	80
96 " "	L or L5 > K	63.15	.498	L 14.01	83
103 " "	M or I6 > L	67.76	.683	M 14.70	88
103 " "	O or K2 > M	67.76	.683	O 15.38	92
92 " "	P or J18 > O	60.52	.378		
95 " "	N or J58 > O	62.50	.492	N 15.85	95
79 " "	N or [illegible] > P'	51.97	.073		

1. Samples dropped from revised scale.
2. The P. E. value or distance of each sample above zero is multiplied by 6 to determine its scale value. The factor 6 is obtained by dividing 95, arbitrary upper limit of scale, by the sum (15.85) of the P. E. values.
3. Table III to be read as Table I.

TABLE IV

SERIAL RANKING OF PICTURE-DRAWINGS

THE TREE: 152 JUDGES

Number of Judges	Comparative Rank of Samples	Percent of Judges	P.E. equivalent of difference between 50% and that part of Judges	P.E. Distance from zero Sample	Scale values derived from P.E. values
	Sample A or B10	—	—	A 0	0
151 Judges ranked	" BorD11>A	99.21	3.50	B 3.50	20
142 " "	" CorF4 >B	93.42	2.236	C 5.84	35
134 " "	" DorE8>C	88.15	1.755	D 7.49	45
120 " "	" EorC12>D	78.94	1.193	E 8.68	52
119 " "	" ForG15>E	78.29	1.154	F 9.84	60
110 " "	" GorF14>F	72.36	.880	G 10.72	65
107 " "	" JorH16>G	70.39	794		
109 " "	" HorH12>G	71.71	951	H 11.67	70
79 " "	" H " >J	51.97	072		
101 " "	" KorI6>H	66.45	630		
90 " "	" IorF17>H	59.21	.345	I 11.91	72
85 " "	" I " >K	55.92	221		
83 " "	" RorL10>I	55.61	.172		
96 " "	" PorI15>I	63.16	.498	P 12.41	75
92 " "	" P " >R	60.53	.396		
93 " "	" SorH18>P	61.25	.424	S 12.83	78
93 " "	" MorQ13>S	61.25	.424	M 13.26	80
80 " "	" NorH6>M	52.61	.098		
94 " "	" OorF9>M	61.84	.446	O 13.70	82
88 " "	" O " >N	57.89	.335		
76 " "	" LorE14>O	50.00	.00		
92 " "	" QorF16>O	60.53	.396	Q 14.10	85
91 " "	" Q " >L	61.84	AAL		

1. Samples dropped from revised scale.
2. The P. E. value of each sample above zero is multiplied by 6, computed as in Table III. The fraction of the number is omitted in all cases. Odd numbers are changed to even save those that are multiples of 5.
3. Table IV to be read as Table I.

the upper limits of the scale. Only the integer of the P. E. values was affected by the factor 5—the fraction being discarded. Both the integer and the fraction in the other themes were affected by the common factor; the P. E. values of rabbit themes were multiplied by 6.7 (Table II), and by 6 in the other themes. See Tables III and IV.

The steps between samples on the house scale are equal for the most part, giving a uniform set of scale values. The steps between samples of the other themes are more or less irregular but the same values on each of these three scales mean practically the same distance from zero, or in other words, a drawing of a rabbit or of a dog or of a squirrel rated 70-75 on the Rabbit Scale equals in achievement a boy running or skating or what not rated around 75 on the Figure in Action Scale: two such drawings assigned the same scale number as found on the two scale sheets in question are assumed to represent the same achievement.

The tree samples produced the shortest scale, 0 to 85 only. The amount of difference in merit grows smaller between samples of higher achievement. Between a few samples the difference is so small that the agreement of the judges falls to 59-60 per cent. If such samples are retained, however, it is because they are of different species of trees. The same principle of retention applies, but with less force, to rabbit and figure in action having unusually small steps but important artistic differences in the plan or style of drawing. See samples I, J, and L in Table II.

DIRECTIONS FOR USING SCALE

(a) *To Pupils.*—Move your drawing along the scale folder until a sample is found that appears to match it. Read the description given below the scale sample, and notice if it describes your own drawing as well. If the description does not apply so well to your own drawing, read that of the sample next below in the scale and compare your drawing with this sample. Now, if your drawing matches the sample and fits the description, write on your drawing the number in the scale. But if the second sample and its description is not so good as the first, move your drawing to the sample that is just above the first that you used and make a similar comparison. If this is more satisfactory than either of the other two, write on your drawing the number on the scale drawing. This number is the score of your drawing. Again, should your drawing have some features that match one sample, and other features that match an adjacent sample give to your drawing a score equal to the average of the two adjacent scale values.

If you wish to get your standing for drawing in representation, as it is called, make four drawings from memory; a house, or any other kind of building, a rabbit or squirrel, a boy running or pitching a ball and a tree. Then grade each according to the directions given above and find the average of the four scores. This average is your standing in drawing as measured by the scale samples.

(b) *To the Teacher.*—To score a drawing compare it at least with three drawings of the scale in the manner of the directions given to the pupil. To ascertain the standing of a class: (1) Classify the drawings according to themes; (2) score all drawings of the same theme before passing to those of another and record the scores in the blanks provided in the score sheet as given in the text; (3) compute

the median and average for each theme separately; (4) find the scale numbers nearest to these averages and medians. They are the class scores for each theme; (5) the average of these scores is the class standing in representation.

To increase the diagnostic value of the scale it should be standardized. To this end the authors earnestly solicit the co-operation of art teachers and subjoin a table showing the form in which reports are desired.

TABLE FOR SCORE SHEETS

Score Sheet for Class in Drawing

TEACHER'S RECORD

Town or City..... School.....

Grade..... Date.....

Pupils' Names	Score for Drawings				
	House	Rabbit	Figure in action	Tree	Averages
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
Average					
Median score					
Median of averages					

Score Sheet for Class in Drawing

[DUPLICATE]

Town or City..... School.....

Grade..... Date.....

Pupils' Names	Score for Drawings				
	House	Rabbit	Figure in action	Tree	Averages
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					
16					
17					
18					
19					
20					
Average					
Median score					
Median of averages					

Send drawings with scores to—

L. W. Kline, Saratoga Springs, N. Y.,

or to

Gertrude L. Carey, Duluth, Minn.

THE MEASUREMENT OF ACHIEVEMENT IN SHORTHAND

No. 1

THE JOHNS HOPKINS UNIVERSITY
STUDIES IN EDUCATION

No. 6

EDITED BY
EDWARD F. BUCHNER

THE MEASUREMENT OF ACHIEVEMENT IN SHORTHAND

BY
ELMER RHODES HOKE, PH.D.

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E. R. H.

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I. INTRODUCTION

During the last fifteen years there has been developing in university schools of education and in the practice of leading educators in the field, what might be spoken of as a movement for measurement in education. Teachers and schools have always felt the necessity for some sort of measure of the results of the educational process. In the past we have attempted to measure school efficiency by means of examinations and teachers' marks. In recent years there has been a growing tendency on the part of educators to give up reliance upon examinations and teachers' marks, and to depend instead upon the results secured by the use of certain tests and scales that have been scientifically constructed.

There are several types of evidence that teachers' marks have been inaccurate. Probably no one who has had several years or more of schooling will have any difficulty in calling to mind teachers who were known as "hard" or "easy" markers. We know full well that an examination paper in geometry marked 95 by one teacher, might be marked 65 by another. In fact, such a paper was, for the sake of the experiment, graded by 116 different teachers. One-third of them marked it at from 27 to 65, one-third between 65 and 75, while the remaining third of the teachers assigned to this paper marks ranging from 75 to 91. The extreme marks given to this paper were 27 and 91.

Again, in almost any high school it will be found that different teachers in the same department will give the same pupils totally different marks, one teacher giving many C's and D's with very few or no A's, while another teacher in the department will give all or nearly all A's, with very few C's or D's. In short, teachers' marks represent a subjective estimate of pupils' achievement. What is needed

is an objective measure of such achievement. In other words, a mark is desired which will reflect the quality of the object, that is, the examination paper or the pupil's performance. The teacher's mark is determined not only by this object, but also in a large measure by the subject—the personality of the teacher.

There are several reasons why teachers' marks are inaccurate. In the first place, the teacher either makes no attempt, or fails in the attempt, to estimate the relative value of the questions of an examination, but merely assigns a value of, say, 10 per cent to each of ten questions, or 4 per cent to each of twenty-five words in spelling. As a matter of fact, one question or one word may be ten times as difficult as another. Whenever experiments have been conducted in which teachers have attempted to judge the difficulty of examination questions, their judgment has been found to be very unreliable. The result is that the score of the pupil who solves the more difficult problems is not a fair statement of his ability or achievement as compared with the scores attained by other pupils on the easier problems. We have no unit of measurement in such a case. The ten points received by one pupil may mean something entirely different from the ten points earned by another pupil on a different exercise. It is as if different grocers had different scales, so that a pound of sugar from one store would contain three ounces, from another store five ounces, from another twelve, and from still another twenty.

Another objection to the teacher's mark is that the rate at which pupils work, or the time required, is not measured. Usually a very long period is given for an examination. The bright pupil will not be occupied during the entire time. His ability has not been measured. Results are therefore not comparable. The same score may represent totally different performances. In one case a score of fifty may mean five exercises correctly done in thirty minutes; in another case it may mean five exercises completed in two hours. Two pupils may get the same score, yet differ widely in ability.

Moreover, the traditional examination and its mark do not afford the teacher any means of interpreting the mark. The teacher has no standard or normal performance with which to compare the achievement of the pupil. No teacher of shorthand has hitherto been able to state as a fact: "My class averages so many per cent above (or below) classes in other schools throughout the country, in ability to read shorthand notes." We have had no suitable standards with which to compare our results. It *is* now possible for an elementary school teacher to say of a boy in her class: "He is just so many per cent above the average boy of his age in the United States in his ability in spelling." The same may be done for handwriting, arithmetic, and other school subjects for which standard tests or scales have been constructed.

It is the purpose of this investigation to construct tests for Gregg Shorthand which will be free from the objections to the traditional type of examination, and at the same time accomplish other desirable results which will be discussed hereafter. The advent of similar tests and scales in other subjects has given an impulse to experimentation in education. This has resulted in better teaching. Whenever an adequate test is developed for any school subject, the teaching of that subject is inevitably improved. It is true that after the test has revealed its facts, the teaching problem is still to be solved and the work of teaching still to be done. But without the facts which the standard test reveals, a very important incentive, and in some cases important suggestions, for better teaching methods are lacking. The standardized test is therefore an instrument which shorthand education can no longer afford to neglect. Experimentation in methods of teaching must await measures of the results of teaching.

The necessity of constructing standard tests for the various school subjects, including shorthand, is stated by Thorndike as follows: "What makes quantitative work in education hard is that it deals with facts of human nature and behavior.

Complexity, variability, and the absence of proper units and scales of measure are the three great difficulties. . . . The complexity must be endured, the variability can be overcome by modern statistical technique, and the lack of units and scales is to be remedied by special investigations."*

We could have no sciences such as physics, chemistry, astronomy or geography if we did not have such measures as those of weight, length, area, volume, and temperature. Just so we can never have a science of education unless we can measure educational facts. Without measures education is a happy-go-lucky, hit-or-miss process. It may accomplish much *good* work, but it can never accomplish the *best* possible work until we can say in education, "I know," not, "I think." We have measures which make it possible for us to *know* how much heavier or taller one boy is than another, even though one be in San Francisco and the other in New York. It is important to be able to know also how much *faster* or *better* the one writes shorthand than the other. For science and progress always wait upon measurement.

Still other values of standard tests should be mentioned. Diagnostic tests will serve to point out specific deficiencies or educational ailments, for which it becomes the duty of the teacher to prescribe and administer a remedy. Indeed, the giving of the test will ofttimes suggest the remedy to apply. Two forms of a test may be used, before and after a given period of experimentation with different methods of teaching, in order to ascertain which of the methods has produced the better results. Again, the standard test often helps to motivate work and secure interest. Pupils will accept the scores they make as just and fair. They will set to work to surpass their own past records. Many pupils do not take teachers' marks seriously, knowing full well that a mark may reflect the teacher's dyspeptic condition or excessively lenient good-nature. The standard test score,

* "Quantitative Investigations in Education." Sch. Rev. Monograph. No. 1. Pp. 35 and 36.

however, is not only recognized as just and fair, but has the added interest that comes from knowing what pupils in other schools are doing. Furthermore, the standard test, such as the scale for quality of shorthand penmanship, makes it possible for the pupil to measure his own achievement and progress. Knowledge of success makes for success. The teacher has a similar satisfaction and incentive in judging her work by comparing her class medians with standard scores. In these and other ways standard tests should make for the improvement of the teaching of shorthand.

In entering upon this investigation it was recognized at the outset that the use of shorthand is a complex process, involving mental and motor aspects—knowledges and skills. An attempt was made to analyze shorthand into its important components and to plan for the measurement of these isolated functions. It seemed that shorthand is made up of a number of processes, indicated by the questions that one would wish to ask with regard to a pupil whose ability in shorthand one desired to know. These questions appear to be four in number: 1. Can he read his notes? 2. How rapidly can he write? 3. How well does he write, or what is the quality of his notes? 4. Does he know the system—*how* to write the outlines? In other words, the important factors which one would wish to measure are 1. reading ability, 2. quality of writing, 3. speed of writing, and 4. knowledge of the system as presented in the text-book. This analysis has determined the plan of the investigation. A reference to the table of contents will show that the sections of this study are attempts to provide measures which will enable one to answer these questions.

It is realized that to undertake to construct such a variety of tests and scales as seems to be required is to attempt a rather ambitious program. It is hoped that some part, at least, of the work shall attain to success, and that from the whole undertaking, some good may flow.

Not much attention will be given in this study to the

methods of administering tests, or to statistical and graphical methods. Those who may wish to use the tests are referred to standard handbooks mentioned in the bibliography for answers to general questions of this sort.

Nor will this investigation touch the question of prognostic tests for shorthand. It appears to the writer to be probable that certain standard tests now in existence will, in combination, serve that purpose well. A pupil who writes a good "hand" will probably write legible notes. A handwriting scale may be used. A pupil who spells well will probably be able to spell well in a somewhat different system (phonetically), and will therefore succeed well so far as knowledge of the system is concerned. A spelling test may be used. Other factors involved, and for which tests are available, are ability to read rapidly, to remember and to associate symbols and make these associations automatic. The shorthand writer must be able to *read* notes, *associate* the shorthand symbols with the letters of the alphabet, and *remember* the word-signs and forms for words. The writer would predict success in shorthand for one who makes good scores on these five tests: handwriting, spelling, reading, association and memory.*

*The writer has recently published a Prognostic Test for Stenographic Ability. This test includes seven elements as follows: motor reaction, speed of writing, quality of writing, speed of reading, memory, spelling, and symbols. See also: Bills, M. A., Methods for the Selection of Comptometer Operators and Stenographers. J. of A. Psych. Sept., 1921, pp. 275-286. Also: A Test for Use in the Selection of Stenographers. J. of A. Psych. Dec., 1921, pp. 373-377.

II. THE CONSTRUCTION OF A SCALE FOR THE MEASUREMENT OF ABILITY TO READ SHORTHAND

When entering upon the problem of constructing some sort of test for the measurement of the student's ability to read correct shorthand notes, the first impulse was to use some of the standardized silent reading tests, simply having them printed in shorthand instead of ordinary type. Further consideration, however, led to the abandonment of this plan, for the reason that it was felt that such a test would measure a confusion of two things, rather than merely reading ability. For the most part such tests require some response from the pupil, and these responses are of some unknown degree of difficulty. One could never be sure how much of the difficulty experienced by certain pupils with such a test would be due to the difficulty of the response called for, and how much to the difficulty in reading the shorthand notes. Some of the reading tests attempt to measure comprehension, usually by asking rather puzzling questions about what has been read. These would be, of all tests, the most unsuitable for the measurement of ability to read shorthand notes.

In order to eliminate this element of difficulty in making the required response, the next suggestion was to use a "simple directions" test, printing the directions in shorthand instead of ordinary type, and accepting the correct response as an evidence of the successful reading of the shorthand. But here again investigation showed that such tests were made up of directions which were *not* "simple," that is, the responses called for were such as involved some degree of difficulty. Again one could not be sure just what part of a given pupil's failure might be due to the difficulty he experienced in understanding the directions and the response

required. The pupil might read the shorthand correctly and yet fail to make the response required by the test.

The ordinary way by which teachers gauge roughly the ability of pupils to read their notes is to have them attempt to transcribe them on the typewriter, or to call upon them to read in class. Sometimes also shorthand readers are used. These methods are all good as classroom exercises but are not very readily capable of greater refinement or of standardization for use as group tests. It is always possible, of course, to standardize, more or less, the procedure involved in testing *individuals* as to their ability to read perfect shorthand notes. But teachers do not have time to go into individual testing very extensively. *Group* tests of reading ability are needed.

The reading of the student's own notes in class is perhaps a good classroom exercise, but can hardly be standardized as a test of reading ability. The transcribing of his notes upon a typewriter is open to a number of objections. The notes themselves are not standardized. Usually they are of different matter, and always vary in their quality as shorthand notes. It is furthermore impossible to say just what part of the total time consumed in the transcription was spent in reading and what part in typing. The good typist might very easily make a better score than the poor typist, even though the latter excelled in his ability to read shorthand. Finally, pupils very often resort to various "cribbing" devices to piece out what they cannot get from their notes.

From all of the foregoing considerations it became evident that an attempt should be made to devise a test in such a way that the particular thing in question, reading ability, would be isolated and measured, in a standardized group test, in which comprehension or the difficulty of making the required responses should play no part. Accordingly an attempt was made to devise a test comprised of "simple directions" which would be really *simple,* that is, directions which involved *zero difficulty.*

To this end teachers, graduate students and friends were asked to contribute questions, exercises or directions, the answer or response to which would involve no difficulty, that is, would be given correctly by as nearly as possible one hundred per cent of all who attempted them. After some efforts along this line the attempt was given up. It seemed that the exercises either involved *some* difficulty or were ridiculous. It might, notwithstanding, be possible to devise a shorthand reading test in this way, but the suggestion came that it would be in many respects more satisfactory to try the completion test method. It was along this line that the test A-1 was actually worked out by a procedure which we shall now describe.

Two actual business letters were selected, having a total length of exactly five hundred words. In these letters every tenth word was underscored to indicate that an alternate word was to be supplied with it, from which the person tested should choose the correct one. The problem arose as to whether the correct word should always be written above the incorrect one. This would evidently be unsatisfactory. The student would soon discover the order. It would be likewise unsatisfactory for the same reason to alternate, having now the correct, now the incorrect word written above. A purely chance order was required. Accordingly a penny was tossed fifty times and the "heads" recorded as meaning that the correct word should be placed above, while the "tails" meant the reverse order.

When it was attempted to select the alternate words it was discovered that, due to the workings of association paths in the mind, the words that suggested themselves were such as had some more or less logical connection with the sentence. This was just what was *not* wanted, for it would mean that the choices would be "fine" ones, requiring a good deal of power of discrimination, or in other words, choices of a considerable degree of difficulty. In order, therefore, to secure such words as would make the choices of practically no difficulty, the Ayres Spelling Scale was resorted to, and

the words taken from one of its columns. When each underscored word was supplied with its alternate it became apparent that in several instances the word chanced to be one which would make fairly good "sense," thereby making the choice of the right word very difficult. Such words were discarded and still others taken, further down the column of the Spelling Scale, until the choices all appeared to be satisfactory.

In order to ascertain whether these word choices were really of approximately zero difficulty, the two letters were mimeographed, together with directions, as follows:

Read the following business letters and draw a line through the incorrect word in each place where a choice of words is called for. Accuracy is more important than speed, so don't do the work faster than you can do it correctly.

DEAR MR. JONES:

We beg to acknowledge receipt of month / note for first annual premium on policy No. 28148 thus putting / extra your policy in full force and effect at once. Dress / In event of your death during this year the policy will / beside be paid in full face value, less this note. Teach / If you should desire to pay this note at any happen / time before its maturity, the same will be discounted at the / begun rate of 4% per annum for balance of year.

Build / You will find enclosed our "Daily Cost of Insurance" setting file / forth the easiest way of meeting such obligations. In order to / provide encourage its method, we will allow 6% discount for all / understand remittances sent us during the year on account of stood / your note, thus distributing its burden and relieving its strain.

Fix / As one of our policy-holders you are a member of / born the Corporation and thus interested with its management in goes / building up its membership. In 1915 our business was considerably in / hold advance of the year 1914, and we are anxious to / drill make the current year a still better one. This army / will no doubt be done, but it will be much follow / easier for us to do it if all our policy stole / holders will contribute their share in the way of interesting income / their friends and in the way of securing their applications.

Paid / May we not have you with us in this good work / enter ? Every new policy-holder will contribute to the greater vitality / railroad of the Fund, and therefore to its surplus accumulations, case / and thus to larger dividends. This incentive for your sympathetic ticket / and active co-operation is therefore worthy of your consideration.

Wishing you account all success in every effort to advance the welfare of while the Fund, we are

Very sincerely yours,

Washington Mutual Real Fund.

DEAR SIR:

We are in receipt of your letter of recover recent date in which you ask us to send mountain booklet and terms on the Smithton Typewriter. Following are our terms steamer to district agents whom we expect will appoint sub-agents as speak well as sell direct:

The Smithton Typewriter is retailing those at $75. Our price to agents is $50 Smithton. If might cash accompanies the order a discount of 2% will be allowed. begin We guarantee our machine for a period of one great year against imperfect parts or mechanical construction and will stand deal back of all sales you make.

We are inclosing an illustrated almost folder of instructions to users of our machine and brought under separate cover mailing one of our dealers instruction booklets. If Less you wish to become our representative in your district event we will ask you to outline by counties the territory you off wish to cover.

With your first order we will furnish true some illustrated folders and also some advertising cuts if you took intend to do local newspaper advertising. We will do miss everything possible to help you get business. We are in inform position to fill orders on twenty-four hours' notice and will both give a preference to our American agents. Hoping to hear from heart you further if interested, we beg to remain,

Respectfully yours. who

In this form the test was given to forty-four boys in the commercial department of the Frederick, Maryland, Boys' High School, and to forty-six girls in the Junior class of Hood College. The papers were subsequently scored. It was found that the girls made the wrong choice in six-tenths of one per cent of the cases, while the boys made the wrong choice in three and one-fourth per cent of the cases. Of 71 errors made by the boys, 36 were on three on the choices: "to-provide," "real-fund" and "file-forth." Of 15 errors made by the girls, 11 were on these same three choices. It appears that in all three cases the words form a "phrase," which fact made the choice confusing. The three difficult choices were therefore changed by supplying other alternate words, such as would avoid this confusion. With this change it appears that the test, as printed in ordinary type, would involve certainly less than two per cent of difficulty, and in the case of the girls, less than one-half of one per cent of difficulty. This seemed to be a satisfactorily close approach to zero difficulty, and accordingly the test was now printed in shorthand, with only the word choices in ordinary type. This test is known as "Test A-1, Reading Ability."

By the opening of the school year of 1921-22 the author was able to report tentative standard scores on this test, based on 233 cases in 16 different classes in 12 different states, as follows:

For those who had one year of instruction in shorthand, a median score of..... 67.
For those who had two years of instruction in shorthand, a median score of..... 80.

Two other business letters, from the same firms, dictated by the same men, and therefore probably of approximately the same style and difficulty, are at hand, for the construction of a second form of the A test. But the publishing and standardizing of a second form has been postponed until further use of the first form shall have fully justified its validity for its purpose.

It should be noted in passing that the directions given with the preliminary testing: "Draw a line through the

incorrect word" were changed on the A-1 test to: "underscore the correct word." One person who tried the preliminary test reported that the required turning of the attention to the *incorrect* word led to some confusion, and that it would be easier to check the *correct* word. The objection seemed well-grounded and the change was made.

Further use of this test with a larger number of pupils, 492 in all, distributed in 33 classes in 17 states, shows somewhat lower standard scores, which appear in the following table:

TABLE I

DISTRIBUTION OF SCORES, AND STANDARD MEDIANS OF A-1 TEST

Class Intervals	1 yr. Class	1½ yr. Class	2 yr. Class	All Classes
161-170	0	0	0	0
151-160	2	0	3	5
141-150	4	0	1	5
131-140	1	1	1	3
121-130	2	1	1	4
111-120	1	1	4	6
101-110	3	7	10	20
91-100	11	10	15	36
81- 90	14	12	18	44
71- 80	42	18	21	81
61- 70	38	30	25	93
51- 60	29	16	16	61
41- 50	39	23	6	68
31- 40	25	18	6	49
21- 30	4	1	0	5
11- 20	3	0	0	3
0- 10	0	1	1	2
No. of cases	218	146	128	492
Medians	63.5	65.7	76.	

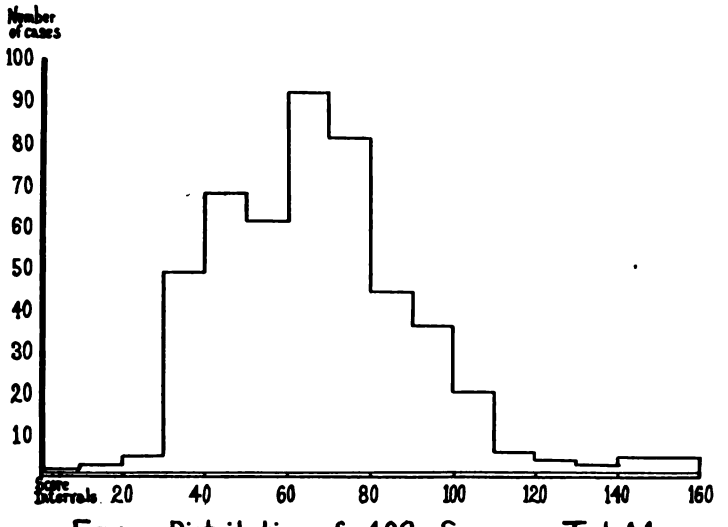


Fig. 1. Distribution of 492 Scores on Test A-1

III. THE CONSTRUCTION OF A SCALE FOR SPEED OF WRITING IN SHORTHAND

The usual way in which teachers of shorthand attempt to measure the speed of writing of their pupils is by dictating certain material to the class, gradually increasing the rate of reading until they can barely succeed in "taking" it. This method is open to several objections. In the first place, it presupposes a "class," whereas in reality there is no such thing as a class. No two in the class can write at exactly the same rate of speed, except by a very remote chance, and yet this test presupposes that a group will be able to take the dictation at a given rate. The method would be more valid if applied to an individual, and even then the teacher should be in a position to see the pupil's notes, so as to know whether the pupil was "keeping after." Otherwise, if the dictation were too rapid, the pupil would be embarrassed and confused by the necessity of remembering the part dictated but not yet written, and the tendency would be cumulative in the direction of a decrease of efficiency, even below the real ability of the pupil.

The method is further open to the objection that the material dictated is not standardized. Its difficulty is not known. The writer has seen classes struggling and growing discouraged, (a condition which is opposed to improvement) when they came upon a difficult section of their dictation book, made up of materials in "heavy" language, perhaps more or less technical. Being accustomed to write 100 words per minute, they now failed to maintain this speed, and were perhaps chided by the teacher for their failure to do what they should never have been expected to do. It would be well if even the dictation practice *exercises* were standardized, so that in all cases pupils and teachers might know what might reasonably be expected of them at their stage of advancement. But certainly *tests* should be on standardized materials.

In an effort to meet the first objection, teachers have sometimes given the class a passage in longhand, and asked them to transcribe it into shorthand. This may be a legitimate classroom procedure, but as a test it is in turn open to some objections. What does it test? Evidently reading ability and knowledge of the shorthand system as well as speed of writing. This ability and this knowledge are important, and well worthy of being tested or measured. But there is a time and place for everything. Certainly a good test will not attempt to measure a number of different things at the same time.

The problem then is: how may a test be constructed to measure the pupil's ability to write shorthand rapidly, such that it will allow each pupil to work at his own rate of speed (he should not be confused by being compelled to write faster than he is able, nor should he find time hanging heavy upon his hands because the dictation is too slow to call forth the best speed that is in him), will employ standard materials of known difficulty, and will afford standard scores for comparison?

To supply a standardized passage in ordinary type with directions that it be copied in shorthand is open to the objection that so much depends upon the pupil's knowledge of the system. Furthermore, much time would be consumed in looking back and forth, from the copy to the line of writing. One who knew the system well and could look back and forth readily without losing his place might win the highest score in such a test, even though he actually *drew* his outlines very slowly instead of really writing them. If the standardized passage were supplied in shorthand, with directions merely to copy it, the objections would be that the pupil must still look back and forth, hunting his place, and that furthermore much time may be lost in the attempt to read the shorthand, for one can not write shorthand readily unless one knows the words and the letters he is writing.

It seemed, therefore, that the pupil should be supplied with the longhand of the passage to prevent his losing time in

reading; that he should be supplied with the shorthand of the passage to prevent his gaining or losing anything in his "speed of writing" score by virtue of his superior or inferior knowledge of the system; and that both the longhand and the shorthand should be given him as he goes, at the rate of speed which just suits him, in such a way that he would not be compelled to look back and forth, hunting his place in the copy. These considerations suggested, what has been called, "the tri-interlinear device" of the tests B-1 and B-2, for speed of writing. It will be noticed that these tests provide three lines, one for the longhand, one for the shorthand, and a line of writing for the pupil's own notes. It is believed that these tests will more nearly isolate the function it is here desired to measure, speed of writing shorthand notes, than will any other sort of test that has been devised. One's eyesight is less taxed, not being required to find the place in the copy. Nothing depends upon one's hearing, as in the case of matter dictated. One's score is not much affected by one's knowledge of the system, for the proper shorthand outlines are indeed "at his pencil's end," supplied in the test. Nothing depends upon memory, as in the case of a test dictated to a group. The writer has known cases where the inferior pupil came out ahead in such tests, simply because when the dictation came too fast they had the ability to store up much of it in memory, to write it later when the dictation was slower or had ceased. This, of course, is a very valuable ability for the practical stenographer, and should be cultivated if possible. But it should not be allowed to intrude when the purpose is to measure speed of writing, isolated from everything else, or as nearly isolated as may be possible.

Copies of the tests, keys, and class record sheets are given in the appendix. They include the necessary directions for giving and scoring the tests. It will be noted that by means of the key supplied to teachers, the tests may be scored in a very small fraction of a minute. In fact, the teacher might score the papers for a large class in less than five minutes.

This is one great advantage of these tests. The resulting "pupil's score" is a score in words written per minute.

It has been reported to the writer that the fastest living writer of Gregg Shorthand tried these tests and found that he could not complete their four hundred words, or more, in the allotted time, two minutes, even though he could ordinarily "take" the same amount of material in dictation in less than two minutes. The obvious reply is that we are not claiming for these tests that they will give the *same* score that some other form of test will yield. The scores in dictation tests will probably be higher. All that need be claimed to establish the validity of these tests is that the *relative* scores of two or more persons who take the tests give a true idea of their relative ability so far as speed of writing is concerned. If they do this as well as other sorts of tests do, and *in addition* supply standard scores, they have at least that advantage to their credit. That no one can complete the tests in the time allowed is not at all disconcerting, but rather most gratifying. It was the purpose to provide more material than any one could finish. Otherwise those who finished before "time" was called would not have been tested.

Tentative standard scores were published in September, 1921, for the B-1 and B-2 tests as follows:

	B-1	B-2
Number of cases	281	265
Number of classes tested	17	15
Number of states represented	11	11
Median for those who had shorthand 1 yr.	55.9	69.1
For those who had shorthand 2 years	73	80.5

Further use of these tests with a larger number of cases, 984 in all, distributed through 32 classes in 15 states for B-1 and 29 classes in 16 states for B-2, yielded the median or standard scores shown in the following table:

TABLE II

DISTRIBUTION OF SCORES, AND MEDIANS OF TESTS B-1 AND B-2

Class Intervals	Test B-1			Test B-2			Both Tests
	1 year Group	1½ yr. Group	2 year Group	1 year Group	1½ yr. Group	2 year Group	All Groups
131-140 ...	1	0	0	0	0	0	1
121-130 ...	2	0	0	0	1	3	6
111-120 ...	2	1	0	1	6	2	12
101-110 ...	2	6	4	6	5	9	32
91-100 ...	1	13	10	9	12	16	61
81- 90 ...	7	15	28	32	32	24	138
71- 80 ...	17	32	19	50	14	27	159
61- 70 ...	50	24	20	62	17	15	188
51- 60 ...	75	24	27	58	12	12	208
41- 50 ...	58	17	11	28	6	4	124
31- 40 ...	25	9	7	4	1	1	47
21- 30 ...	6	1	1	0	0	0	0
11- 20 ...	0	0	0	0	0	0	0
No. cases..	246	142	127	250	106	113	984
	515 cases on B-1			469 cases on B-2			
Medians ..	55.6	69.5	70.	66.6	82.1	79.3	

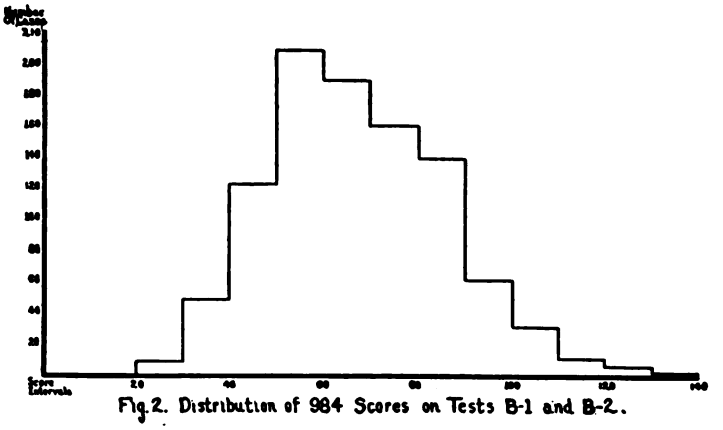


Fig. 2. Distribution of 984 Scores on Tests B-1 and B-2.

Tentative standard scores for the two forms of the B tests seem, at first sight, to indicate that B-2 is less difficult than B-1, inasmuch as the norms set for the two forms are approximately ten points higher for B-2 than for B-1. It would, of course, be very unfortunate if two forms of any test differed so widely in difficulty. The two selections were made with a view to having them of approximately equal difficulty. They were taken from the same writing, and appear to be similar in style.

Fortunately, there was evidence to show that in all the cases upon which these tentative norms were based, B-1 was given first, and B-2 second. There was a possibility, therefore, that the difference of ten points might be due to the effect of practice, especially in view of the fact that the test is quite different in its nature from anything the students were likely to have done before. Accordingly when the two forms of the B test were given to the ninety-six cases, as described elsewhere, they were given in the reverse order: B-2 before B-1. The result was that the median score for B-1 was found to be, not lower, but actually six points higher than the B-2 median. The practice-effect may have been more or less in this case than in other places. Taking these results as typical, however, they would indicate a difference in difficulty of only two points—an almost negligible difference. It is recommended that those using the tests should read the norms given for B-1 as the standards for the first use of a B test, and similarly for the norms given for B-2.

IV. THE VALIDITY AND RELIABILITY OF THE A AND B TESTS

Two questions which should be asked with regard to every test are: 1. Is it valid? 2. Is it reliable? In other words, the first question is whether the test measures the function it pretends to measure; the second question asks whether the test or the different forms of the test measure that function consistently. A test may be very interesting and very cleverly arranged, yet really useless if it does not measure the function it is intended to measure. Again, a test is comparatively worthless if it gives widely differing results on two or more successive applications. In that case we say it is not trustworthy, or not reliable. It is incumbent upon anyone who offers tests to teachers for their use to inform them as to the extent to which the tests may be trusted to do the thing they are said to do, and to do it consistently. To answer these questions a number of investigations have been made.

The Validity of Test A-1

In searching about for an absolute measure of reading ability, with which the results of the A test might be compared, so as to show its measure of validity, the author decided upon the plan of giving individual, timed tests in reading. An arrangement was made with the Boys' High School, Frederick, Md., whereby the boys of the Commercial Department were permitted to come to the office, one at a time. The writer met each boy, explained to him the purpose of the work, and the fact that the results would not affect him in any way, thus trying to get the best possible *rapport*. The boy was then requested to begin reading aloud from a page of printed shorthand notes (Gregg Speed Studies, page 156, "Productive Employment"). Each reading was carefully timed with a stop-watch for three minutes, and the number of the last word read was recorded. This number was regarded as a gross result, from which the number of

words "prompted" was subtracted to get the net number of words read. In prompting, the experimenter allowed exactly five seconds, in every case, before giving the help. The net number of words read was divided by the number of minutes (three) to get the net number of words read per minute. These scores were considered sufficiently reliable measures of the pupils' reading ability to justify their being adopted as a criterion.

Test A-1 was then used with this same group of boys, and after an interval of a week, used a second time. These two sets of scores were averaged and the average scores correlated with the individual-timed reading scores. The resulting coefficient of correlation, using the Pearson formula, was .55, P. E. .08. The correlation with the first use of A-1 yields a somewhat lower coefficient, while with the second use of A-1 the coefficient of correlation is somewhat higher than that given. Furthermore, two or three of the brighter boys tried to "beat" the test the second time they took it, by guessing at the word-choices, thus trying to accomplish a greater part of the work than they could otherwise do. Their guesses proved rather unfortunate. Inasmuch as the method of scoring the test calls for subtracting the number wrong from the number right, these boys received very low scores—much lower than on the first trial of the test, when they followed directions honestly. If these scores were left out of account, the coefficients of correlation would be nearly ten points higher, that is, approximately .65 with a correspondingly lower P. E. However, even the obtained coefficient, .55, is regarded as satisfactory evidence of the validity of the test. This statement needs to be qualified, however, by a recognition of the fact that the number of cases was perhaps too small (forty-one cases) to be conclusive.

The Reliability of the A Tests

As mentioned above, test A-1 was used twice with the group of forty-one boys, with approximately one week intervening between the two uses of the test. These two

sets of scores were correlated to show the extent to which the test is reliable, or consistent, in yielding the same sort of results on successive trials. The self-correlation of test A-1 was found to be that expressed by the Pearson coefficient .80, P. E. .04. This coefficient seems quite satisfactory, though here again it needs to be remembered that the number of cases was rather small.

The author's experience in the use and the scoring of the A-1 test indicates that while the results secured from the first use of the test are good, the second use of the same test yields somewhat better and more reliable scores. This appears to be due to the fact that the nature of test is "strange" to the pupils. On the second trial they get the "swing" of it and do themselves justice. The same remarks apply with equal force to the B tests. Experience with the results in those cases where pupils, knowing the author personally, tried to "beat" his test by guessing at the word-choices, justifies those who use the test in warning the class that the test and its scoring are such that "the cards are stacked" *against* those who guess. The chances are that they will make better scores by honest work than by guessing. Teachers can very readily tell when guessing has been resorted to. Given the context, the word-choices are of approximately zero difficulty. Honest papers usually show no mistaken choices, so far as they go. Or at most, they may show one or two mistaken choices. When pupils guess they will have a much larger and very noticeable number of mistakes.

The Validity of the B Tests

Miss Brewington of the University of Chicago gave a group of thirty-four pupils two forms of the B test. To the same group was assigned the task of copying familiar printed shorthand from a page of a text-book for three minutes. All scores were reduced to a words-per-minute basis. The B-1 and B-2 scores were averaged, and the average scores correlated with the scores derived from the timed readings from good, printed shorthand notes. The

Pearson coefficient of correlation was found to be .51 with a P. E. of .09. The correlations with either of the B tests alone were approximately the same. This coefficient is worthy of some consideration as showing the validity of the tests, though the number of cases must be admitted to be too small.

A similar experiment was made in the High Schools of Frederick, Md. Ninety-six pupils were given the two forms of the B test. They were also given an original test, which may be described as follows: A selection of fifty words from "Rip Van Winkle" was written on the blackboard in good shorthand notes.

> "He was observed at first to vary on some points every time he told it, which was doubtless owing to his having so recently awaked. It at last settled down precisely to the tale I have related; and not a man, woman, or child in the neighborhood but knew it."

The teachers then read the shorthand to the class and had them copy it three times for practice and to familiarize them with the text and the outline. Practice papers were then laid aside and the pupils were told to write the matter as often and as rapidly as they could, for three minutes. The teachers gave the signals "start" and "stop" and kept the time carefully. Papers were then collected and scored, in words per minute.

The correlation of the scores on this original test with the average scores made on the two forms of the B test yields the coefficient .73 P. E. .03. This coefficient is regarded as quite satisfactory and the number of cases as fairly large. These results tend to show the validity of the B tests. Taken together with the results secured by Miss Brewington, they show that the B tests will give, in a few minutes, scores very similar to those derived from other, unstandardized tests devised with a view to measuring the same function, speed of writing. The B tests have the advantage of being more convenient, requiring less time to administer and score, and affording standard scores for comparative purposes.

The Reliability of the B Tests

Scores received from Miss Brewington on the two forms of the B test for fifty-seven individuals, show a self-correlation expressed by the Pearson coefficient .83 with a P. E. of .03.

Self-correlation of the ninety-six scores on the two forms of the B test administered in the Frederick High Schools is found to be .87, P. E. .02.

Here we have a fairly large number of cases (one hundred and fifty-three in all) and a close agreement between the two coefficients, tending to show that the true degree of self-correlation will probably be found to be between .80 and .90, or at any rate, high enough to justify the B tests from the standpoint of their reliability.

TABLE III

Coefficients of Correlation Showing Validity and Reliability of the A and B Tests

Scores Correlated	No. cases	r	P. E.
Average of two scores on A-1 with stop-watch-timed individual test	41	.55	.08
Self-correlation of A-1	41	.80	.04
Average of B-1 and B-2 with copying from text-book 3 min. (Chicago)	34	.51	.09
Average of B-1 and B-2 with writing familiar text 3 min. (Frederick)	96	.73	.03
B-1 with B-2 (Chicago)	57	.83	.03
B-1 with B-2 (Frederick)	96	.87	.02

V. THE CONSTRUCTION OF A SCALE FOR SHORTHAND PENMANSHIP

For the purpose of constructing a scale for the measurement of the quality of Gregg Shorthand penmanship, a collection of specimens of shorthand was made in a uniform way. From "The Legend of Sleepy Hollow" and "Rip Van Winkle," both from Irving's "Sketch Book," two hundred and fifty-four selections were made, of exactly fifty words each. These selections were cut from the books and glued upon cards three by six inches in size, both in the shorthand and in the longhand. These cards were distributed to pupils in various schools, together with a sheet five and one-half by eight and one-half inches, upon which were printed the outlines of two squares, three by three and one-half inches each, together with the directions:

> "Number..... (Write here the number given on the card.) Copy the shorthand given on the card in the upper space first, then again in the second space."

The purpose was to regard the first writing as practice, and to *use* the second in the actual construction of the scale. Most of the cards were copied by four different individuals. By means of the number at the top of the page each specimen can be identified, and by turning to the card with the corresponding number, the key to the shorthand may be found.

Teachers were instructed to allow pupils to use either pen or pencil and to allow them sufficient time so that all might finish. They were also instructed to secure specimens from all pupils, regardless of the degree of proficiency or advancement in shorthand.

In this way eleven hundred and fifty-five specimens were secured. The names of the schools and the number of specimens secured from each are as follows:

Western High School, Baltimore, 615; High School of Commerce, New York, 165; Schenley High School, Pittsburgh, 96; The Baltimore Business College, 79; Baltimore City College, 25; Girls' High School, Frederick, Md., 50; Boys' High School, Frederick, Md., 42;

The Harrisburg (Pa.) Shorthand School, 28; The Lancaster (Pa.) Business College, 26; individuals, 3; The Gregg Publishing Company, 6; Johns Hopkins University, Summer Session, 20.

The six specimens secured from the Gregg office were written by experts. The twenty specimens secured in the University Summer Session were written by persons, none of whom had ever had any instruction in shorthand whatsoever. These twenty-six specimens were secured in this way after it had been found that the more than eleven hundred specimens contained few if any that were good enough for the upper end of the scale, or poor enough for the lower end.

The entire eleven hundred and fifty-five specimens were graded by five judges. The judges were told to sort the

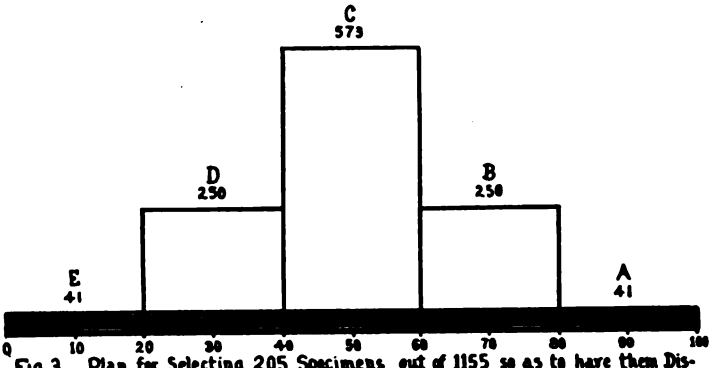


Fig. 3. Plan for Selecting 205 Specimens out of 1155 so as to have them Distributed at Approximately Equal Intervals over the scale. The Shaded Area Represents the 205 Specimens Retained. The White Area Represents the 950 Specimens Discarded.

specimens into five piles, very good, good, medium, poor, and very poor, in such a way that approximately one-half of the entire number would be in the middle or medium group, about forty specimens each in the very good and very poor groups, with the rest about equally divided between the good and the poor. In other words, a normal distribution was assumed, with the percentages for the five groups approximately three, twenty-two, fifty, twenty-two and three. It was felt that this would assist the judges in giving a better rating than would probably be the case without such guidance.

The five judgments on each specimen were then averaged and on this basis a selection was made of approximately forty-one specimens of each grade, very good, good, medium, poor and very poor. This meant that in all only two hundred and five specimens were retained for further grading, while the great bulk, nine hundred and fifty specimens, representing a surplus of material at about the middle part of the scale, could be at once discarded. It was believed that the two hundred and five specimens, so selected, would include an adequate number for each step of the scale. (See figure 3.)

Twelve additional judgments were then secured for the two hundred and five specimens, in accordance with the following directions:

DIRECTIONS FOR GRADING 205 SPECIMENS OF SHORTHAND

Preliminary—Shuffle thoroughly like cards.

I

Sort the 205 specimens into five piles (A, B, C, D, E, or Very Good, Good, Medium, Poor, Very Poor) so that there are not less than 34 nor more than 44 in any one pile. If there are more or less than these numbers in any pile, re-sort the larger piles at least in part.

II

Re-sort each of the five piles into two, so that you get the better and the worse halves, with not over 25 or under 15 in each half. This step will give you ten piles, from the worst, which we will arbitrarily call 1, to the best which we will call 10.

III

Turn each of the ten piles over and write on the back of each paper, under the numbers already there, at the left hand edge, its score (i. e., 1, 2, 3, 4, 5, 6, 7, 8, 9, or 10). SHUFFLE.

Here the assumption was that there were approximately an equal number of specimens representing each of the five groups. For this reason the directions were given for the guidance of the judges in such a way as to rule out of account their personal opinions as to the absolute quality of the specimens. What was wanted was their judgment as to the relative qualities of the specimens.

There were now five and twelve, or in all seventeen, judgments recorded for each specimen. With the aid of an adding machine these seventeen judgments were averaged, counting the digits as tens (thus 6 would count as 60,) and

counting the values of the five groups of the original judgments as 90, 70, 50, 30 and 10. The values of the two hundred and five specimens, secured by thus adding their points, were then arranged in order from the best to the worst.

From the two hundred and five specimens, so evaluated, forty specimens were now selected, such that their point values differed by approximately equal amounts. By this procedure it was believed that a series of specimens was secured, ranging, by approximately equal steps in value, from the very poorest, of approximately zero value, to the very best, a specimen of perfect shorthand, written by an expert, the value of which is approximately one hundred.

These forty specimens were then engraved (see appendix) and five hundred and fifty duplicate sets struck off, which were mailed to as many different teachers of shorthand all over the United States, with the request that they judge them in accordance with the following directions:

To Gregg Shorthand Teachers:

For nearly two years I have been working on a scale for measuring the quality of Shorthand Penmanship. Now I have reached the stage in my work when I must send this appeal for co-operation to 500 teachers of Gregg Shorthand.

Some time in January the completed scale will be ready. A copy will be sent you gratis in return for your co-operation.

I wish to have the 40 specimens sent you herewith graded from the standpoint of their quality or general merit as shorthand penmanship. Will you please co-operate with me in this work by giving me the benefit of your judgment?

THE FOLLOWING PLAN IS SUGGESTED:

1. Sort the forty specimens into five groups of about eight specimens each, as follows: VERY POOR, POOR, MEDIUM, GOOD, VERY GOOD.

2. Now take each of these groups in turn and divide it into the better and worse halves. This will give you ten groups of four specimens each.

3. Take up one group after the other and arrange the four specimens from the standpoint of their merit as shorthand penmanship.

4. When you have gone through each group in this way you will have arranged the entire forty specimens in such a manner that the best is on the top and the worst at the bottom, with the others graduated all the way between.

5. Put the specimens, arranged in this order from best to worst, in the return envelope, and post.

May I assure you your co-operation in this matter will be greatly appreciated. Sincerely yours,
(Signed)

When the time arrived that the judgments should be in hand, it was found that 250 teachers had responded by arranging the specimens in the order of their quality from the best to the worst, and returning them in this order. A considerable number of judges reported less promptly. Fifty of these were later included in the study, making 300 in all. The resulting data are given in a table† in which the judges are indicated by the numbers at the left hand margin, from 1 to 300, and the ranks by the numbers at the top of the table, from 1 to 40. The main body of the table is made up of numbers which identify the several specimens, to which the numbers from 1 to 40 were assigned in a purely chance order. To illustrate, if judge number 1 considered specimen 10 to rank thirteenth, then "10" would be written opposite 1 and under 13.

TABLE IV
AVERAGE RANK OF 40 SPECIMENS OF SHORTHAND

No. of Specimen	Average Rank	No. of Specimen	Average Rank
11*	1.872	4	20.408
32*	3.164	10	20.672
23*	4.260	19	20.796
24*	6.104	5	21.148
27*	6.988	9*	21.180
28*	9.282	37	25.484
26	10.728	36*	25.516
17	10.960	40	28.020
38*	11.052	8*	29.628
3	12.152	14	31.156
2	12.592	25	31.164
13*	13.744	1	32.480
15	14.512	6*	32.556
12	15.392	31	32.980
34*	15.692	7	33.464
20	16.768	39	33.492
18	17.072	29	34.076
30	17.912	16	34.220
22	17.964	35*	34.620
33*	18.760	21*	39.812

† This table is not reproduced here. Anyone who is interested in these original data will find them in the author's dissertation on file in the library of the Johns Hopkins University.

* Indicates the specimens included on the scale.

After the results were compiled for the first 250 judges to report, the average rank of each of the specimens was computed with the aid of a calculating machine. This was done in order to ascertain the relative values or ranking of the specimens. The result is shown in Table IV.

The next step was to count the number of judges who considered each specimen superior to the next best, and then, with the aid of the table given by Thorndike in his "Mental and Social Measurements" (pp. 122, 123, Table 23) to ascertain the differences in the values of the specimens in terms of P. E. This method is based upon the theory that "equally often noticed differences are equal." The amounts of difference are shown in Table V.

In connection with his explanation of this method Thorndike says: "The method as a whole presupposes that the observations are made by judges of some competence. Its precision depends upon how competent they are." Something needs, therefore, to be said with reference to the judges employed in this work.

When the Gregg Publishing Company called upon teachers of shorthand to lend their aid in the construction of shorthand scales and tests, about four hundred responded, expressing their willingness to try such tests and cooperate in their development. This was a very gratifying response, and would seem to indicate on the part of these teachers some degree of understanding of the nature and value of standard measures, as well as a spirit of willingness. Believing that no more capable, intelligent, and willing body of judges could be found, the writer decided to invite the cooperation of these teachers in judging the specimens. The 150 additional sets were sent, for the most part, to shorthand teachers in the schools of certain large cities, notably Baltimore and Los Angeles. A few were sent to individuals known to be expert in shorthand. Many expressions of interest were received from the judges. A number reported that the work was difficult. All indications seemed to point to the fact that in general the judges performed

TABLE V

VALUES OF THE 40 SPECIMENS

Number of specimen	Considered better than	Number of judges in 300	Per cent of better judgm'ts	Per cent of worse judgm'ts	Amount of difference	Value in terms of P. E.
11	32	218	72.7	27.3	.90	11.53
32	23	177	59.	41.	.34	10.63
23	24	196	69.3	34.7	.58	10.29
24	27	202	67.3	32.7	.66	9.71
27	28	199	66.3	33.7	.62	9.05
28	26	159	55.	47.	.11	8.43
26	17	161	53.7	46.3	.14	8.32
17	38	150	50.	50.	.00	8.18
38	3	164	54.7	45.3	.18	8.18
3	2	167	55.7	44.3	.21	8.00
2	13	166	55.3	44.7	.20	7.79
13	15	153	51.	49.	.04	7.59
15	12	176	58.7	41.3	.33	7.55
12	34	150	50.	50.	.00	7.22
34	20	172	57.3	42.7	.27	7.22
20	22	166	55.3	44.7	.20	6.95
22	18	152	50.7	49.3	.03	6.75
18	30	155	51.7	48.3	.06	6.72
30	33	174	58.	42.	.30	6.66
33	4	176	58.7	41.3	.33	6.36
4	5	170	56.7	43.3	.25	6.03
5	19	152	50.7	49.3	.03	5.78
19	10	157	52.3	47.7	.08	5.75
10	9	159	53.	47.	.11	4.81
9	37	208	69.3	30.7	.75	5.56
37	36	159	53.	47.	.11	5.67
36	40	179	59.7	40.3	.37	4.70
40	8	159	53.	47.	.11	4.33
8	25	181	60.3	39.7	.39	4.22
25	14	160	53.3	46.7	.12	3.83
14	6	171	57.	43.	.26	3.71
6	31	152	50.7	49.3	.03	3.45
31	1	154	51.3	48.7	.05	3.42
1	7	157	52.3	47.7	.08	3.37
7	39	152	50.7	49.3	.03	3.29
39	29	161	53.7	46.3	.14	3.26
29	35	173	57.7	42.3	.29	3.12
35	16	153	51.	49.	.04	2.83
16	21	291	97.	3.	2.79	2.79
21					0	0

their work in a most careful and intelligent manner. The geographical distribution of judges is also quite satisfactory,* representing 38 States and Canada.

Table V gives the values of the 40 specimens of shorthand in terms of P. E. From inspection of this table it now became possible to select specimens in such a way that they would differ from one another in value by approximately five points, on a scale of 100 points. Thus were selected the sixteen specimens whose values appear on Table VI. This

TABLE VI

VALUES OF SPECIMENS INCLUDED IN SCALE

Specimen No.	Is considered better than No.	Number of judges out of 300	Per cent of better judgments	Per cent of worse judgments	Amount of difference	Values of specimens in terms of P. E.	Differences times 8.25	Value in terms of nearest whole number	Values assigned on scale
11	32	218	72.7	27.3	.90	11.41	94.13	94	95
32	23	177	59.	41.	.34	10.51	86.71	87	90
23	24	196	65.3	34.7	.58	10.17	83.90	84	85
24	27	202	67.3	32.7	.66	9.59	79.12	79	80
27	28	199	66.3	33.7	.62	8.93	73.67	74	75
28	38	184	61.3	38.7	.42	8.31	68.56	69	70
38	13	198	66.	34.	.61	7.89	65.09	65	65
13	34	179	59.7	40.3	.37	7.28	60.06	60	60
34	33	212	70.7	29.3	.81	6.91	57.01	57	55
33	9	186	62.	38.	.45	6.10	50.32	50	50
9	36	201	67.	33.	.65	5.65	46.61	47	45
36	8	207	69.	31.	.74	5.00	41.25	41	40
8	6	201	67.	33.	.65	4.26	35.14	35	35
6	35	194	64.7	35.3	.56	3.61	29.78	30	30
35	21	294	98.	2.	3.05	3.05	25.16	25	25
21					0	0	0	0	0

table should be read as follows: Specimen No. 11 is considered better than specimen No. 32 by 218 out of 300

* Arizona, 3, Alabama, 1, California, 23, Colorado, 5, Connecticut, 3, Delaware, 1, Florida, 2, Idaho, 1, Illinois, 32, Indiana, 7, Iowa, 9, Kansas, 3, Minnesota, 10, Montana, 1, Maine, 8, Massachusetts, 19, Missouri, 3, Michigan, 18, Mississippi, 1, Maryland, 27, Nebraska, 6, New Mexico, 1, North Dakota, 1, New Hampshire, 2, New Jersey, 13, New York, 26, Ohio, 9, Oregon, 4, Oklahoma, 1, Pennsylvania, 19, Rhode Island, 4, South Dakota, 1, Tennessee, 1, Texas, 5, Vermont, 4, Virginia, 2, Washington, 8, Wisconsin, 15, Canada, 1. Total, 300.

judges; that is, 72.7 per cent of the judges consider it better, or 27.3 per cent consider it worse. By reference to the table it is found that 27.3 per cent of worse judgments corresponds to a difference in value of .90 P. E. This, added to the value of No. 32 (10.51) gives No. 11 a value of 11.41. In order to raise these values to a scale of 100 points, one P. E. is taken to be 8.25 points. All the values as given in the seventh column of the table are therefore multiplied by 8.25 to get the values in the eighth column. In the case of No. 11 this value is 94.13. The nearest whole number is 94. The value assigned this specimen on the scale is 95.

Specimen number 21 was written by a person who knew nothing of shorthand. It is clearly intended to be shorthand, though illegible as such. Its value is assumed to be zero.

It may, perhaps, be noticed that the values assigned the specimens in Table V and Table VI vary somewhat. This fact requires an explanation. It is due to the fact that in the latter table the specimens are taken, not in the order of their rank, but in some of the steps one or more specimens are passed over. In the first table specimen 28 is compared with 26, and considered superior by 53 per cent of the judges. In the latter table 28 is compared with 38, and found superior by 61.3 per cent of the judges, making the difference in value between 28 and 38 in the latter table. .42 P. E., whereas in the former table their difference is the sum of three steps of difference, .11, .14, and .00, or .25.

The fact of the existence of these differences might at first sight seem to invalidate the method. In reality the facts appear to justify the conclusion that the judging has in this case been very well done. A comparison of the values assigned the specimens in the two tables will show that the largest variation is .31 P. E. The fact that this variation is so small argues the care and precision with which the work of the judges has been done. In any event, the variations are so small, as they affect the scale, that they will not mar its practical value. In other words, the differences

are so small as probably to fall below the power of human discernment.

The sixteen specimens so selected were finally arranged for publication in the form of a scale, a copy of which, together with a copy of the Class Record Sheet prepared for use with the same, is included in the appendix. Copies of the scale and record sheets were promptly sent to the three hundred teachers and others who had judged the specimens, with the request that they use the scale as per directions given on the Class Record Sheet, and report the results on a duplicate of said sheet. Such reports were secured for 1627 cases. A study of these results is given in the Tables VII and VIII and Figures 4 and 5.

The graphs indicate a normal distribution of the scores for speed, but a very much skewed distribution of scores for quality, with a marked tendency to give too many of the very high scores, 85, 90, and 95. This is probably due largely to the fact that those who have used this scale are for the most part persons who have not had previous training in the use of a quality scale. It is probable, furthermore, that the habit of giving grades of 90 to 95 in high schools, carries over here in spite of the scale.

The medium scores for quality (77.4 and 81.5) show an improvement of only 5.3 per cent in one year's work, whereas the median scores for speed (45.8 and 64.4) show an improvement of 46.1 per cent in one year.

TABLE VII

Quality of Pupils' Shorthand Notes

Scale Scores	No. of cases Group 1	No. of cases Group 2	No. of cases Both groups
95	92	75	167
90	121	89	210
85	147	129	276
80	142	82	224
75	144	74	218
70	96	43	139
65	71	26	97
60	48	19	67
55	40	15	55
50	29	17	46
45	20	15	35
40	25	18	43
35	17	8	25
30	8	4	12
25	9	4	13
under 25	0	0	0
Total No. cases.	1009	618	1627
Median scores..	77.4	81.5	

(Note.—In this and the following table Group 1 had 29 weeks of instruction; Group 2, 66 weeks.)

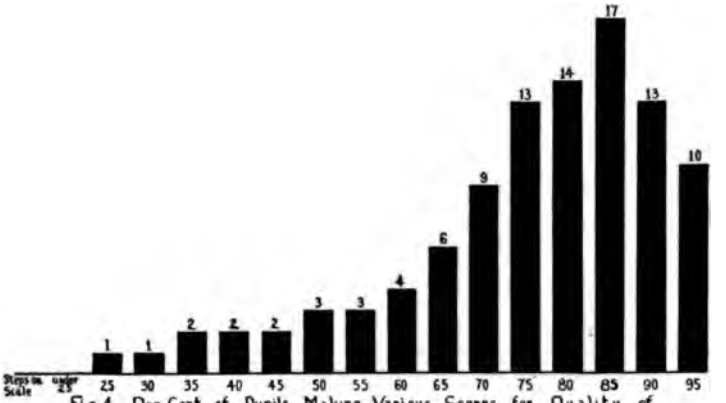


Fig. 4. Per Cent of Pupils Making Various Scores for Quality of Shorthand Penmanship. 1627 Cases

TABLE VIII

SPEED OF PUPILS' SHORTHAND NOTES

Scores in words per min.	No. of cases Group 1	No. of cases Group 2	No. of cases Both groups
131-140	1	0	1
121-130	0	1	1
111-120	1	4	5
101-110	9	10	19
91-100	5	28	33
81- 90	9	80	89
71- 80	42	99	141
61- 70	106	154	260
51- 60	196	150	346
41- 50	315	64	379
31- 40	230	24	254
21- 30	89	3	92
11- 20	4	1	5
0- 10	0	0	0
Total No. of cases	1009	618	1627
Median scores	45.8	64.4	

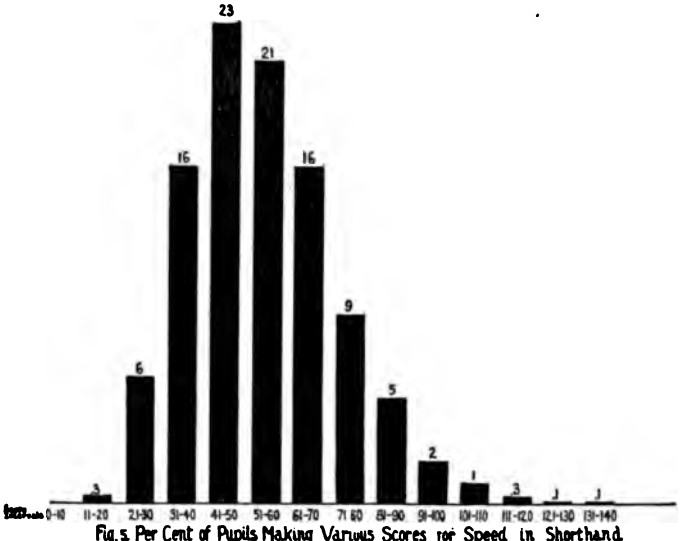


Fig. 5. Per Cent of Pupils Making Various Scores for Speed in Shorthand Penmanship, in Words per Minute. 1627 Cases.

Table IX shows the relationship between speed and quality of notes for 700 cases, including both first and second year pupils. The coefficient of correlation has been found to be .22 with a P. E. of .02. This may be interpreted as indicating that the positive relationship is present, but not in any very marked degree. If in our high schools the improvement during the second year's work were as great for quality as for speed, the degree of relationship would probably be found to be considerably higher than that indicated by the coefficient .22.

TABLE IX

RELATIONSHIP BETWEEN SPEED AND QUALITY OF SHORTHAND NOTES

Scores for Quality	Scores for Speed										
	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–100	101–110	111–120
95		5	15	18	11	15	14	4	1	1	
90		9	16	25	29	19	2	4	3		
85		13	15	38	29	16	6	6	3		
80		3	24	24	22	17	4	3	1		
75	1	4	19	21	17	18	4	1	2	1	
70	1	5	17	16	15	4	3	1			
65		4	7	9	8	1		1			
60	1	1	8	4	5	4		1			
55		1	5	6	3	2	4				
50		2	5	2	1		3				
45		2	7	4	1	2					1
40		3	7	4	1		2				
35		4	3	2							
30			1	2	1						
25			1								

No. of cases: 700.
Coefficient of correlation .22.
P. E. .02.

VI. THE CONSTRUCTION OF A SCALE FOR KNOWLEDGE OF THE SYSTEM

How shall the pupil's knowledge of the system of shorthand be measured? In the first effort to devise a measure for knowledge of the system, a collection was made of such questions as teachers of shorthand are accustomed to ask on their "examinations." The purpose was to select a few of such questions or exercises calling for knowledge of the system, and to form preliminary tests from which the difficulties or values of the several exercises might be ascertained, after which such of them as seemed suitable could be made into one or more forms of a test for knowledge of the system of Gregg Shorthand. After the collection was made, however, the result was such a chaos that when an alternate plan suggested itself, this original plan was given up. The plan adopted appeared to hold out the promise of being, if not easier of accomplishment, certainly the more useful of the two.

This second plan was to take the 1,000 commonest words as given in the Ayres Spelling Scale, make them up into preliminary vocabulary tests in shorthand, and from these, ascertain the difficulties or values of the 1,000 words from the standpoint of shorthand writing, which would make it possible to arrange these words in a Shorthand Scale, similar in style to the spelling scales.

Further consideration, however, showed the necessity for a revision or enlargement of this plan, for it was recognized that knowledge of shorthand includes the ability to write *phrases* as well as words. For this reason it seemed necessary that such a scale should include the values of phrases as well as words. Accordingly, the first impulse was to include with the 1,000 commonest words the approximately 570 phrases given in the Manual. Investigation showed, however, that at least some of these were of rather infrequent

occurrence, and a knowledge of them, therefore, not very important. It was concluded that an investigation should be made in the effort to secure a list of the 500 most common phrases in actual use. Inasmuch as this investigation was of the same nature as that of Ayres leading to his list of 1,000 commonest words, it may be well to describe, very briefly, both investigations.

During the years 1914 and 1915 the Division of Education of the Russell Sage Foundation conducted a study with the object of developing a scale for measuring the attainment of school children in spelling. For this purpose an effort was made to select the commonest words in the English language. This was accomplished by combining the results of four investigations, each of which aimed at identifying the commonest words.

These four studies were: First, Rev. J. Knowles, London, England, 1904, "The London Point System of Reading for the Blind," including a tabulation of 100,000 words from the Bible and various authors; second, R. C. Eldridge, Niagara Falls, 1911, "Six Thousand Common English Words," including a tabulation of 43,989 words; third, Russell Sage Foundation Monograph, 1913, "The Spelling Vocabularies of Personal and Business Letters, with a tabulation of 23,629 words; fourth, Cook and O'Shea, 1914, "The Child and His Spelling," including a tabulation of some 200,000 words.

By combining these four studies, including a total of about 368,000 words, written by more than 2,500 different persons, it was found possible to select a list of 1,000 words with the highest frequencies, which may therefore be regarded as the commonest words in the English language, so far as our information goes.* The thousand words constitute about 92 per cent of ordinary composition. These words were arranged in the form of a scale and published in a monograph entitled, "Measurement of Ability in Spelling," which

* More recently Thorndike's "Word-Book for Teachers" has been published, giving the 10,000 most common words, and superseding all earlier studies.

has proved to be a very important contribution to the teaching of spelling. It is believed that the teaching of shorthand may be no less aided by the use of these same words in the form of a shorthand scale, especially since these words will constitute so large a part (92 per cent) of all that the stenographer will ever be called upon to write.

An investigation, similar to those which were combined in the study just described, was made for the purpose of deriving a list of the most common phrases in such literature as stenographers are accustomed to "take." The material used for this purpose comprised the following books: the "Legend of Sleepy Hollow" and "Rip Van Winkle" from Irving's "Sketch Book;" "Gregg Speed Studies;" "Alice's Adventures in Wonderland," by Lewis Carroll; "Graded Readings in Gregg Shorthand," by Alice M. Hunter; "The Art of Making a Speech;" "Gregg Shorthand Reader;" and two popular dictation books, containing modern business letters and literary matter, "Dictation Course in Business Literature, Book I," Reigner, the H. M. Rowe Co., and Eldridge's "Shorthand Dictation Exercises," by the American Book Company.

This body of material is estimated at approximately 500,000 words. Much of the material may be had from the publishers of Gregg Shorthand in the form of expert notes. It was a simple matter to tabulate the phrases as used by the writers of these notes. The authority of the publisher's experts is back of the selection of the phrases. Otherwise there might be some difference of opinion as to what words should be "phrased." In the case of the material for which no shorthand notes are published, the plan was to have an expert teacher of shorthand underscore with a pencil the groups of words which should be phrased in writing. Clerical workers then went over these sheets and counted the phrases as underscored.

6,418 different phrases were tabulated, with the number of appearances of each—a total of 41,421 phrases. Incidentally, the great importance of phrasing for success in

shorthand work may be seen from the fact that there occurs on the average one phrase to every ten or twelve words.

It was then discovered that by selecting from the entire mass of material all phrases which had been found to occur fourteen or more times, a list of 500 phrases was secured, which may with some justification be regarded as the 500 commonest phrases in the English language, or at least in those forms of literature included in the investigation. Approximately three-fifths of this material consists of business letters. The remainder is of miscellaneous sorts, including literature, newspaper editorials, extracts from addresses, and so forth.

It should be noted that in counting the frequencies of the phrases included in the 500, the frequencies of other less common phrases, of which certain of these form a part, were added. For example, the phrase, "and have" was credited also for all occurrences of such phrases as, "and have the," "and have you," etc. This was done for the reason that it was felt that only by so doing would the several phrases be given the importance that they deserve.

Those who are acquainted with shorthand will not need an explanation of the fact that many combinations of words are included in the list which are not phrases in the ordinary sense of the word "phrase" as used in grammar. For the purpose of this investigation any group of words written "joined," or together, is regarded as a phrase.

The total of the frequencies of the 500 commonest phrases is 32,353, out of a total of 41,421 phrases tabulated, or 78 per cent. This means that pupils who master the 500 phrases will be able to write not less than 78 per cent of all phrases they meet, as a result of this practice alone. The fifty commonest phrases have a total frequency of 16,903, or about 41 per cent of all the phrases tabulated.

The 1,000 commonest words and 500 commonest phrases were arranged in ten Vocabulary Tests, (for which see appendix) known as C-1, C-2, . . . C-10, including 100 words and 50 phrases to each test. The words and phrases for the

several tests were selected in a purely chance order, by taking for test C-1 every tenth word or phrase, for C-2 the words and phrases next following, and in like manner for the other eight tests. These tests simply give the words and phrases in columns, with spaces opposite for the student's outlines. On the first page of each test will be found all the directions required by the teacher.

It is believed that the material included in these ten tests will ultimately have great value as a body of drill material for the teacher's use. Inasmuch as these words make up approximately 92 per cent of ordinary composition, and the phrases 78 per cent of all phrases commonly met with, it will be found a very effective method of teaching, to drill this small body of material until thoroughly mastered by the pupil, so that it may be written rapidly and correctly. This will improve speed of writing, and will go a long way in securing legibility.

In order to secure data for the calculation of the values or difficulties of the words and phrases, teachers of shorthand were invited to cooperate in the construction of the scale by using the tests with their classes and returning them for scoring and tabulation.

In order that the tests might be scored in accordance with a uniform procedure, the scoring was not left to the teachers, but instead the teachers were requested to send in the tests themselves, after having scored them for their own purposes. The tests were given just before the close of school in June, 1921. 2,818 tests were received, an average of 281.8 for each of the ten forms of the C tests. These were scored in accordance with the following directions:

STANDARD DIRECTIONS FOR SCORING THE C TESTS

1. All words and phrases are to be scored strictly in accordance with the Gregg system, as per key.*
2. Where the key gives two forms, either should be counted correct.
3. The dot for "h" on words like "had" may or may not be used. Count is correct with or without the dot.

* The key was prepared by a committee of experts appointed by the Gregg publishers, and is regarded as authoritative.

4. Capital letters not indicated by „, counted wrong.
5. Whenever the intention of the writer was correct, give full credit, even though the word is poorly written. This is not a test for quality of writing.
6. If the word or phrase is so poorly written that you cannot be sure the writer had the correct thing in mind, count it wrong.
7. Pay no attention to other marks made by teachers. Only the marks made in our own scoring will be counted. Use a blue pencil.
8. The first consonant should be reasonably near the line of writing. One-sixteenth of an inch is reasonably near. If further from the line of writing, count it wrong. (This rule does not apply to such consonants as s, x, w, h, and sh.)

In accordance with these standard directions, three different clerical helpers shared in the work of scoring tests C-1, C-2, C-3, C-4 and C-5, while the remaining five forms were all scored by a single person. The median number of correct responses on the first five tests was 116.4, while on the last five it was 117.2. This indicates a variation of eight-tenths of a point in the scoring of the tests by different persons, showing that the scoring of vocabulary tests is more objective than might have been supposed. This argument is based on the assumption that the ten forms of the C test are of equal difficulty. Inasmuch as each form represents a purely random selection of 150 elements from a list of 1,500, the assumption seems a perfectly rational one.

A study of the following table appears to the writer to justify these conclusions:

1. That the ten forms of the C tests are approximately equal in difficulty.
2. That the work of different scorers is satisfactorily objective.
3. That the number of cases is large enough to insure the reliability of the norms within three or five per cent. The extreme variation between the medians is found between C-1 and C-4, 8.5 points, or 5.7 per cent of the total 150 points.

TABLE X

NUMBER OF CASES AND MEDIAN SCORES ON THE C TESTS
(2818 CASES)

	No. of cases in different groups by years				Median scores for groups who had studied shorthand the time indicated, in years.			
	1	1½	2	All	1	1½	2	All groups
C- 1	158	162	45	365	107.2	115.9	115.5	111.7
C- 2	144	103	45	292	110.6	122.3	115.	115.3
C- 3	127	85	47	259	107.9	121.5	118.3	115.1
C- 4	115	95	44	254	115.	123.9	122.1	120.2
C- 5	138	81	54	273	114.	125.3	122.6	119.5
C- 6	114	79	62	255	113.7	121.2	112.1	115.7
C- 7	108	91	67	266	113.6	124.5	121.8	120.
C- 8	108	93	89	290	111.2	123.4	119.4	119.
C- 9	167	79	52	298	112.6	122.	117.5	116.
C-10	133	80	53	266	112.4	121.9	114.	115.4
Avg. 1-5	136	105	47	288	110.9	122.	118.7	116.4
Avg. 6-10	126	80	65	275	112.7	122.6	117.	117.2

The distribution of ability in knowledge of the system as measured by the C tests is indicated on the following graph.

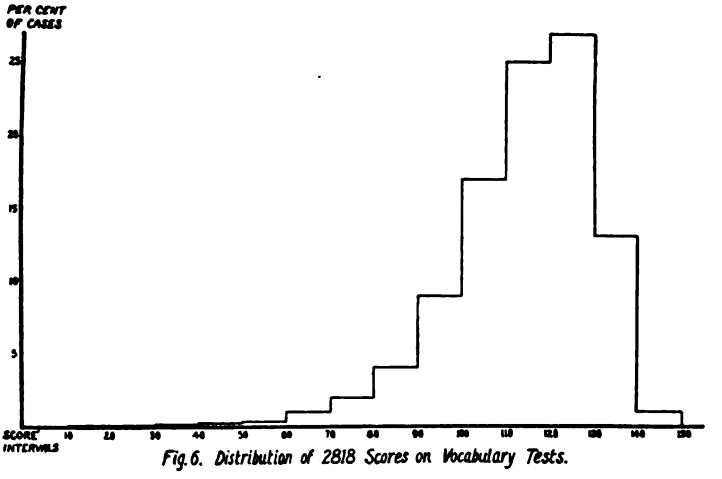


Fig. 6. Distribution of 2818 Scores on Vocabulary Tests.

It will be noticed that there is a scattering .9 of one per cent of the 2,818 cases who make scores ranging from 0 to 60 per cent correct responses on the C tests. From 60 to 100

per cent or from 90 to 150 points the distribution shows a fairly close approximation to that of normal frequency.

The most noticeable feature of the results found for the three groups who had had shorthand instruction one year, one and one-half years, and two years respectfully, is the fact that their medians show very slight differences. The improvement from the first year to the one and one-half year group is approximately 8 per cent, while from the one to the two year group it is only 4 per cent. The fact that the second year group seems to be slightly inferior to those who had a half year less instruction, is probably to be explained as due to the selection of the schools tested. But taken with the other facts just noted, it does justify the conclusion that the second year of shorthand instruction makes very little improvement in the pupil's ability to use the system.

These facts, together with the further fact that the distributions for the different groups are very similar, are shown by the following table of quartile points. The figures indicate percentages of correct responses.

TABLE XI

QUARTILE POINTS IN PER CENT OF CORRECT RESPONSES FOR GROUPS WHO HAVE HAD INSTRUCTION THE NUMBER OF YEARS INDICATED

	1 yr.	1½ yrs.	2 yrs.	All
Q1	67	75	71	70
Q2	74	81	78	78
Q3	81	86	84	84

The similarity of the three curves is shown in Figure 7. The writer regards the above figures, together with the other facts that have been presented, as satisfactorily justifying the procedure which was followed in preparing the scale for knowledge of the system. This procedure we must now describe.

After all the test sheets had been carefully scored in accordance with the standard procedure already described, the number of incorrect responses to each of the 1,500 words and phrases was counted, the percentage of incorrect re-

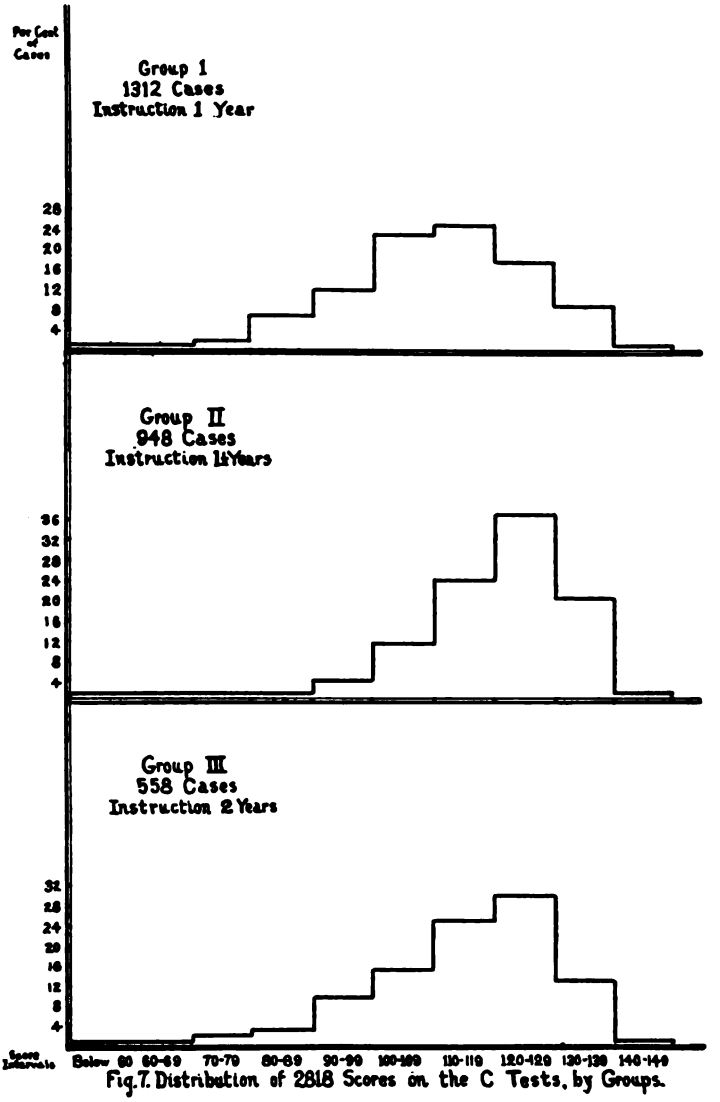


Fig. 7. Distribution of 2818 Scores on the C Tests, by Groups.

sponses to each word was calculated, and from this figure the percentage of correct responses to each word or phrase was derived. Each word and phrase was then placed in the column of the scale (for which see appendix) to which its record showed it to belong. This means, therefore, that words or phrases found in the column marked "84" for example, have been found to be of such difficulty that if a test be made up of these words and given to a class of pupils who have had from one to two years of instruction in shorthand, the class should make a median score of approximately 84 per cent, if it is up to "standard."

In arranging this scale the plan used by Ayres in constructing his Spelling Scale has been adopted. For an explanation of the theory underlying this type of scale the reader is referred to his monograph, "The Measurement of Ability in Spelling." The final paragraph of his discussion, however, applies with equal force to this scale, and is therefore quoted with the change of just a few words. "In all such testing it must be remembered that the present scale . . . will become increasingly and rapidly less reliable for measuring purposes as the children become more accustomed to *writing* these particular words *and phrases*. In proportion as these lists are used for the purposes of classroom drill, the scale will become untrustworthy as a measuring instrument. Probably the scale will have served its greatest usefulness in any locality when the school children have mastered these 1,000 words *and 500 phrases* so thoroughly that the scale has become quite useless as a measuring instrument." (Changes or additions are denoted by italics.)

Inasmuch as the differences in ability between the three separate groups tested are so small as to be negligible, no differentiation is made on the scale between the norms for those who have had shorthand instruction one year, one and one-half years, or two years. The words were placed in their respective columns on the basis of their record in all three groups combined. For those who have had shorthand but one year the norms may be regarded as approximately

one-half step too high. For those who have had instruction one and one-half or two years, the norms are probably a half step too low. It would be statistically possible, of course, to work out this scale in such a way as to make the slight differentiations which the data seem to show. To do so, however, would be to set up a foolishly elaborate statistical procedure, based on a fundamental procedure in collecting data which was not of so extended or perfect a nature as to justify the elaboration. It would, furthermore, be making distinctions of such unimportant proportions that they would be invalidated or outweighed by minor variations or errors in the procedure of giving and scoring tests. It is felt that such elaboration would lay one open to a very just charge of straining at a gnat and swallowing a camel, particularly in view of the fact that the average number of cases on which each word was scaled was only 282.

VII. SUMMARY

We have seen that the measurement of shorthand ability involves the measurement of reading ability, speed of writing, quality of writing, and knowledge of the system. Accordingly we have constructed tests and scales as follows:

1. Test A-1, Reading Ability.
2. Tests B-1 and B-2, Speed of Writing.
3. A Measuring Scale for Gregg Shorthand Penmanship.
4. A Scale for Measuring Knowledge of Gregg Shorthand. (The data for this scale were derived from the use of ten Vocabulary Tests, C-1 to C-10.)

From the use of these tests and scales data have been collected which seem to justify the following suggestions as to the teaching of shorthand:

1. The scores for reading ability are too low for efficiency in stenographic work. More practice needs to be given in reading shorthand.
2. The second year group shows an improvement of only five per cent over the first year group in quality of shorthand penmanship. This condition calls for some remedy.
3. The question of "artistry" versus mere legibility in shorthand penmanship needs to be settled. After pupils have attained to a legible shorthand, there is little justification for spending time in the effort to get beauty.
4. The one school whose results in shorthand penmanship were most outstanding, used the device of having students who had trouble in the formation of their outlines, trace them by using tracing paper, until they got the "swing of it."
5. In knowledge of the system the second year group does no better than the first. The explanation is probably to be found in the lack of a definite goal and in scattered and wasted practice.
6. Emphasis should be placed upon drill or practice with a view to the mastery of the 1,000 commonest words and 500 commonest phrases. These make up 92 per cent of the words in English composition, and 78 per cent of the phrases.
7. Many pupils fail to write words clearly, even though they have memorized the rules involved. Emphasis should be placed upon writing correctly, rather than upon the rules of the system.
8. Tablets containing the 1,500 words and phrases appropriately arranged in drill sheets, would be an effective teaching device.
9. The data derived from the nearly 3,000 vocabulary tests, nearly 450,000 attempts to write words and phrases, show the degree of accuracy to be approximately 78 per cent. More intensive practice on a smaller number of the most common words and phrases would greatly improve this record.

BIBLIOGRAPHY

AYRES, LEONARD P. (1915). The Measurement of Ability in Spelling. Russell Sage Foundation, New York.

———Measuring Scale for Ability in Spelling.

———A Scale for Measuring the Quality of Handwriting.

———Report. No. E 113. A Sale for Measuring the Quality of Handwriting.

BILLS, M. A. Methods for the Selection of Comptometer Operators and Stenographers. Journal of Applied Psychology. Sept., 1921, Volume 5, pp. 275-283.

———A Test for Use in the Selection of Stenographers. Journal of Applied Psychology. Dec., 1921, Volume 5, pp. 373-377.

BOOK, W. F. (1908). The Psychology of Skill: With Special Reference to Its Acquisition in Typewriting. University of Montana. Publications in Psychology: Bulletin No. 53, Psychological Series No. 1.

BUCKINGHAM, B. R. (1913). Spelling Ability: Its Measurement and Distribution. Teachers College Contributions to Education, No. 59.

BURGESS, MAY AYRES (1921). The Measurement of Silent Reading. Russell Sage Foundation, New York.

ELDRIDGE, EDWARD H. (1909). Shorthand Dictation Exercises. American Book Company, New York.

FREEMAN, FRANK N. (1914). The Teaching of Handwriting. Houghton Mifflin Company, New York.

GREGG PUBLISHING COMPANY, New York, publications:

Alice's Adventures in Wonderland. (Shorthand.)
The Art of Making a Speech. (Shorthand.)
Rip Van Winkle. (Shorthand.)
The Legend of Sleepy Hollow. (Shorthand.)
Gregg Speed Studies.
Graded Readings in Gregg Shorthand.
Gregg Shorthand Reader.
Gregg Dictionary.
Gregg Phrase-book.
The Vocabulary of the Gregg Shorthand Manual.
Practice Drills in Shorthand Penmanship.
Articles on Shorthand Penmanship published monthly in the O. G. A. Department of the Gregg Writer.

HILLEGAS, M. B. A Scale for Measuring the Quality of English Composition by Young People. Teachers College Record, Volume XIII, No. 4, 1912.

HUEY, EDMUND B. (1906). The Psychology and Pedagogy of Reading. The Macmillan Company, New York.

IRVING'S SKETCH BOOK, Selections from. American Book Company, New York.

MCCALL, WILLIAM A. (1922). How to Measure in Education. The Macmillan Company, New York.

MONROE, W. S. (1918). Measuring the Results of Teaching. Houghton Mifflin Company, New York.

MONROE, W. S., DEVOSS, J. C. AND KELLY, F. J. (1917). Educational Tests and Measurements. Houghton Mifflin Company, New York.

PARKER, S. C. (1915). Methods of Teaching in High Schools. Ginn and Company, New York.
REIGNER, C. G. (1917). Dictation Course in Business Literature, Book One. The H. M. Rowe Company, Baltimore.
RUGG, H. O. (1917). Statistical Methods Applied to Education. Houghton Mifflin Company, New York.
THORNDIKE, E. L. (1914). Educational Psychology: Briefer Course, Teachers College, Columbia University.
———(1913). Mental and Social Measurements. Teachers College.
———Handwriting. Teachers College Record, Volume XI, No. 2, 1910.
———(1921). Word-Book for Teachers. Teachers College, Columbia University.
TRABUE, M. R. (1916). Completion-Test Language Scales. Teachers College. Contributions to Education, No. 77.
WILSON, G. M. and HOKE, K. J. (1920). How to Measure. The Macmillan Company, New York.
YEARBOOKS of the National Society for the study of Education:
Fourteenth, Part I, Minimal Essentials.
Fifteenth, Part I. Standards and Tests.
Sixteenth, Part I. Minimal Essentials.
Seventeenth, Part I. Economy of Time in Education. Part II. Measurement of Educational Products.
The Public School Publishing Co., Bloomington, Illinois.

APPENDIX

Pupil's Score.....

A SERIES OF TESTS IN GREGG SHORTHAND

Arranged by Elmer Hoke, A. M.

Copyright, 1921, by the Gregg Publishing Company

TEST A-1 *Reading Ability*

Published by

THE GREGG PUBLISHING COMPANY

285 Fifth Avenue, New York City

Name.....Age.....
Years Months

Race.....Sex.....Grade.....

City.....State.....Date.....

School.....Teacher.....

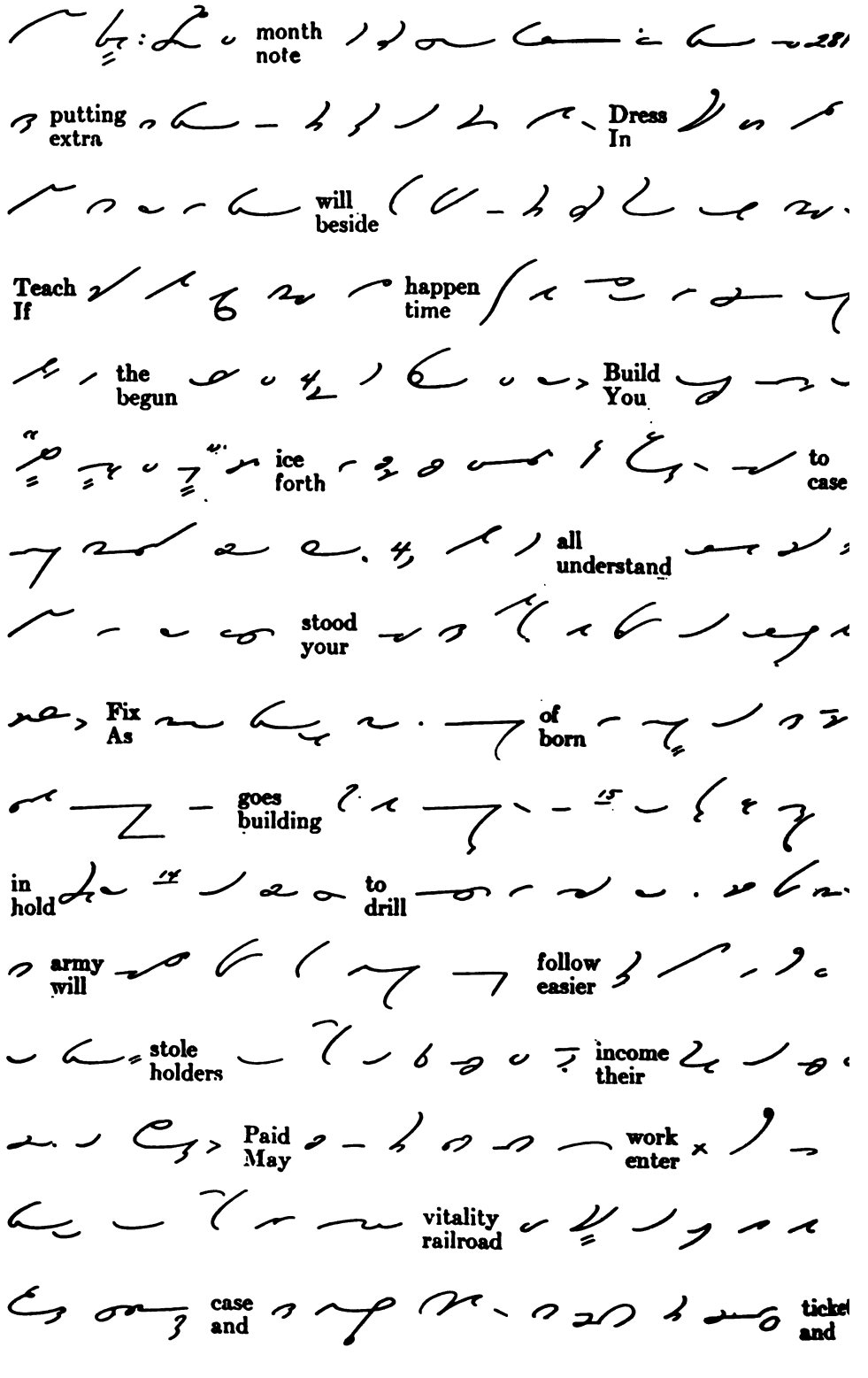
Directions for Giving Test

1. Distribute papers face up on the desks. Ask pupils not to open papers until the signal is given.

2. Have pupils fill in blanks on the cover page or as many of them as may be desired.

3. Then say: "On the inside of this folder are two letters in shorthand. Read these business letters, and in each case where a choice of words is given, *underscore the correct word*, so that the letter will make sense. Accuracy is as important as speed. When I say, 'Ready, start,' open your paper and work for three minutes, until I say, 'Stop.'"

4. With watch in hand carefully keep the time; allow exactly three minutes, when the signal "Stop" should be given and papers collected.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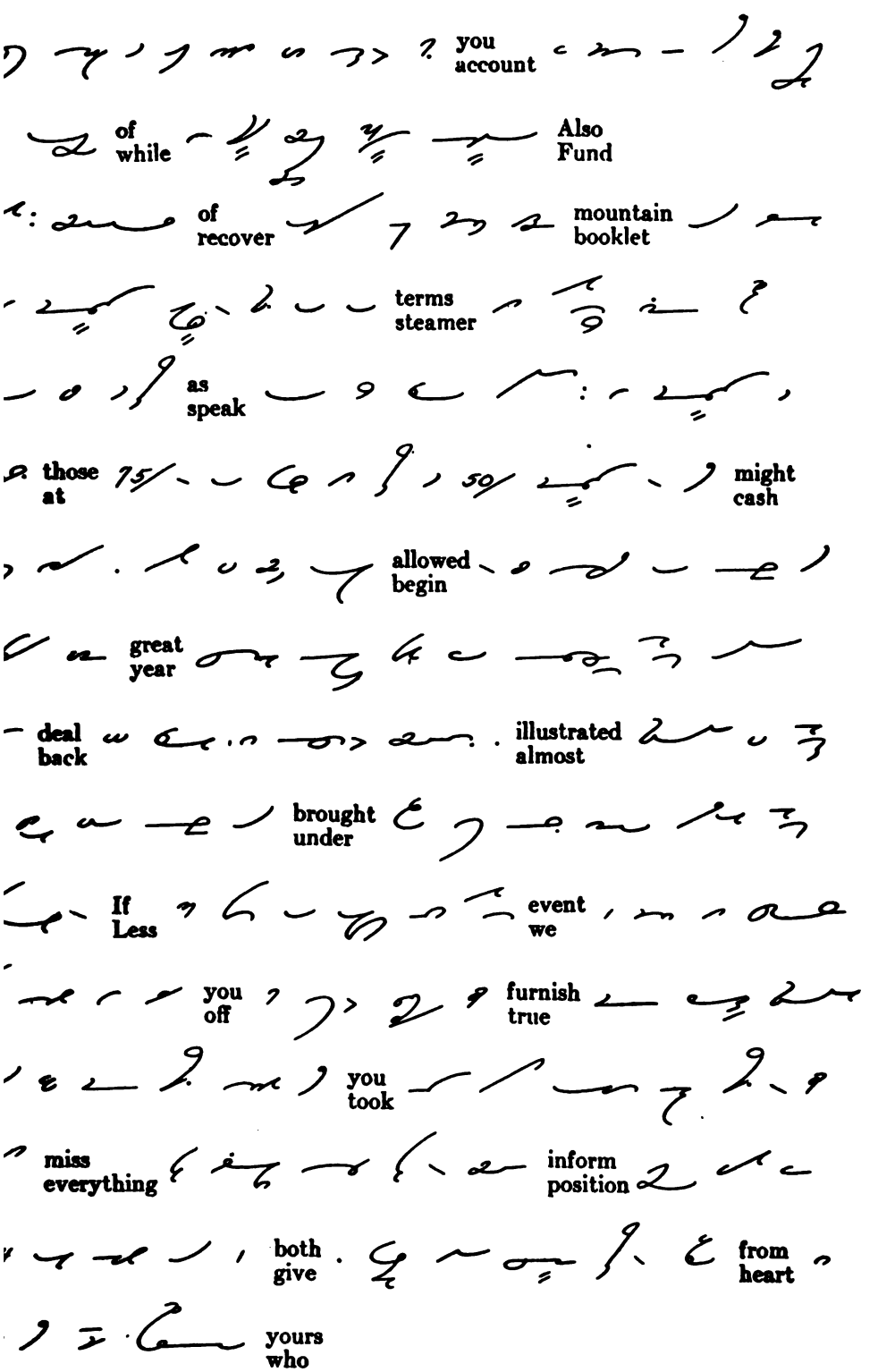
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22 May
23 work
24 vitality
25 and
26 and
27 you
28 of
29 Fund
30 of
31 booklet
32 terms
33 as
34 at
35 cash
36 allowed
37 year
38 back
39 illustrated
40 under
41 if
42 we
43 you
44 furnish
45 you
46 everything
47 position
48 give
49 from
50 yours

Teacher's Key to Gregg Shorthand
Test A-1

Directions for Scoring

In scoring these tests lay the key beside the paper an with a red pencil make a check mark on the margin of th paper opposite each wrong choice if any. The word given in this key are the words which should be unde scored. If the other word is underscored, or if neith or both are underscored, it is counted wrong.

Find the number of the last choice made by referenc to the number opposite that word on this key. Fro this number deduct twice the number of wrong choice made. Example: Suppose the last choice made i "work," No. 23. And suppose two wrong choices ar made. Twice two, or four, subtracted from 23, leave 19, the net number of correct choices.

Refer to the Class Record Sheet. Make a tally mar in the space after the number of net choices. The accom panying score may then be placed on the pupil's pape at the place indicated. The number of tally marks in eac space on the Class Record Sheet may then be counted an extended to the second space, showing the number o pupils in each group. (Scores show the number of word read correctly per minute.)

Send one copy of the Class Record Sheet to the

GREGG PUBLISHING COMPANY
285 Fifth Avenue
New York City

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CLASS RECORD SHEET

To be used with Series A Tests in Gregg Shorthand.

ity.....State.....Date.....

chool.....Teacher.....Grade.....

Net Number of Correct Choices	Score	Tallies	No. of Pupils	Net Number of Correct Choices	Score	Tallies	No. of Pupils
50	167			25	83		
49	163			24	80		
48	160			23	77		
47	157			22	73		
46	153			21	70		
45	150			20	67		
44	147			19	63		
43	143			18	60		
42	140			17	57		
41	137			16	53		
40	133			15	50		
39	130			14	47		
38	127			13	43		
37	123			12	40		
36	120			11	37		
35	117			10	33		
34	113			9	30		
33	110			8	27		
32	107			7	23		
31	103			6	20		
30	100			5	17		
29	97			4	13		
28	93			3	10		
27	90			2	7		
26	87			1	3		

Send one copy of this sheet to the Gregg Publishing Company, New York City.

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Pupil's Score.....

A SERIES OF TESTS IN GREGG SHORTHAND

Arranged by Elmer Hoke, A. M.

TEST B-1 *Speed of Writing*

Published by

THE GREGG PUBLISHING COMPANY

285 Fifth Avenue, New York City

Name.....Age.....
Years Months

Race.....Sex.....Grade.....

City.....State.....Date.....

School.....Teacher.....

Directions for Giving Test

1. Distribute papers face up on the desks. Ask pupils not to open papers until the signal is given.

2. Have pupils fill in blanks on the cover page, or as many of them as may be desired.

3. Then say: "On the inside of this folder there is an article of 400 words. The article is printed both in longhand and in shorthand. When I say, 'Start,' open your papers and copy the shorthand as rapidly and as neatly as possible in the space left for that purpose. I will allow exactly two minutes. No one will be able to finish. When I say, 'Stop,' raise your pencils or pens immediately."

4. With watch in hand carefully keep the time; allow exactly two minutes, when the signal "Stop" should be given and the papers collected.

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Note.—The first page of Test B-2 is identical with this and will therefore not be given. Pages 2, 3 and 4 of Test B-2 are given immediately following this test and Key.

Thinking I Can

The twentieth century formulators of business ethics have builded squarely

upon the basis that respect for the good and true begins with the pronoun of the

first person. No man can really be true to himself who has not an abiding faith

in himself. Here lies the chief corner stone of scientific salesmanship. The

first important selling transaction with which one can be identified is a three

cornered transaction. He is the salesman, purchaser, and the thing sold. For

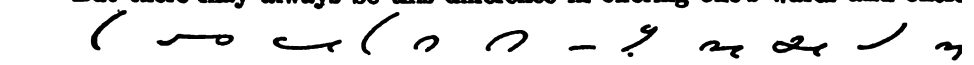
no salesman—and that term includes every man or woman who earns a living by

hand or head—can be a success in this life until he has succeeded in selling himself

to himself. When he has once made that confident analysis it should be easy for him

to apply the same principles to other commodities which he may offer for sale

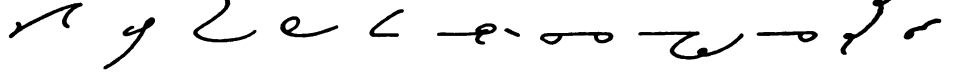
But there may always be this difference in offering one's wares and onese



for sale: in the former case the price is regulated by the law of supply and demand

but in the latter case the price is arbitrary. Indeed I may be an autocrat an

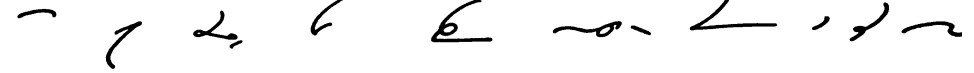
stamp whatever value I will upon myself. I may imprint my services with th



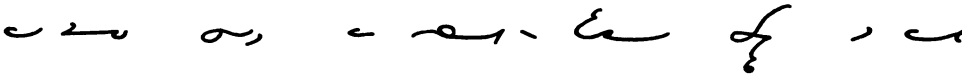
mental trade-mark of superiority and carefully store them away against the

hour of made-to-measure customers, or I may throw myself upon the bargai

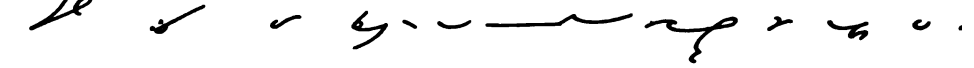
counter to be fingered over by the basement crowd. Every man is first grea



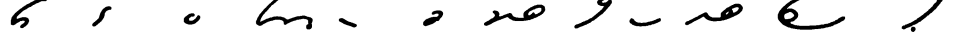
or small according to his own calculation. Spiritual bankruptcy is alway



several days ahead of the sheriff. Our mental collapse is the result of

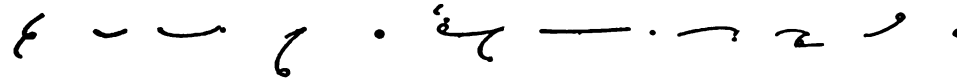


poor system of bookkeeping. We strike off our trial balance, having



underscored self-liquidating liabilities, and overlooked important assets.

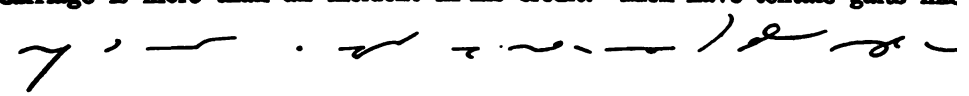
People are willing to believe a self-helping man a going concern until he



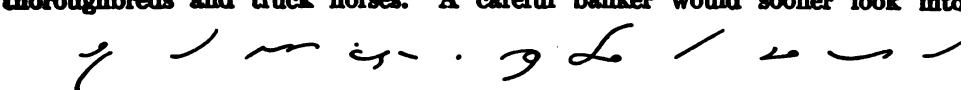
stops discounting his bills and begins to walk stoop-shouldered. Emerson said

that the best lightning rod for self-protection is one's spine. Indeed one's

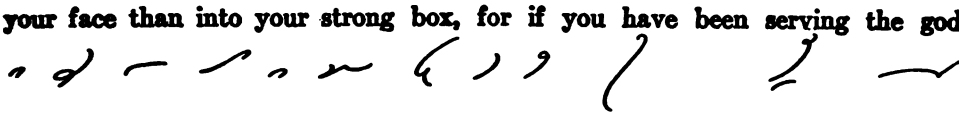
carriage is more than an incident in his credit. Men have telltale gaits like



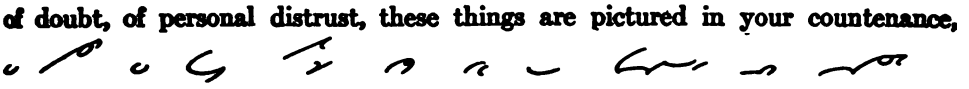
thoroughbreds and truck horses. A careful banker would sooner look into



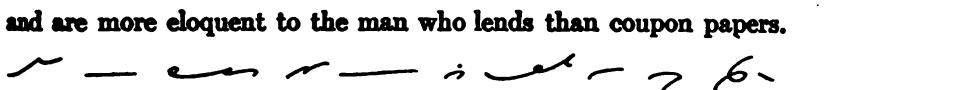
your face than into your strong box, for if you have been serving the god



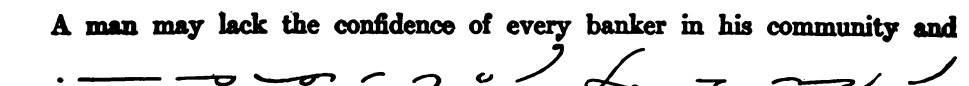
of doubt, of personal distrust, these things are pictured in your countenance,



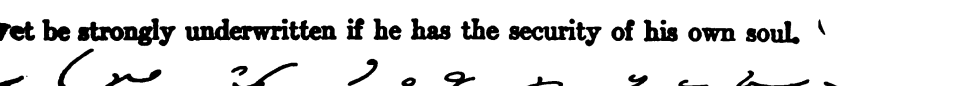
and are more eloquent to the man who lends than coupon papers.



A man may lack the confidence of every banker in his community and



yet be strongly underwritten if he has the security of his own soul.



Teacher's Key to Gregg Shorthand Test B-1

In scoring Test B-1 find the last word written by the pupil, and refer to the following key to find number of that word. Divide by two to find the score in words per minute; mark this score on pupil's paper, and tally the same on the Class Record Sheet.

Thinking I Can

1 2 3 4 5 6 7 8 9 10
The twentieth century formulators of business ethics have builded squar
11 12 13 14 15 16 17 18 19 20 21 22 23 24 25
upon the basis that respect for the good and true begins with the pronoun of
27 28 29 30 31 32 33 34 35 36 37 38 39 40 41
first person. No man can really be true to himself who has not an abiding fa
43 44 45 46 47 48 49 50 51 52 53
in himself. Here lies the chief corner stone of scientific salesmanship.
55 56 57 58 59 60 61 62 63 64 65 66
first important selling transaction with which one can be identified is a thr
68 69 70 71 72 73 74 71 76 77 78
cornered transaction. He is the salesman, purchaser, and the thing sold.
80 81 82 83 84 85 86 87 88 89 90 91 92 93
no salesman—and that term includes every man or woman who earns a living
95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110
hand or head—can be a success in this life until he has succeeded in selling hims
112 113 114 115 116 117 118 119 120 121 122 123 124 125
to himself. When he has once made that confident analysis it should be easy
127 128 129 130 131 132 133 134 135 136 137 138 139 140
him to apply the same principles to other commodities which he may offer for sa
142 143 144 145 146 147 148 149 150 151 152 153
But there may always be this difference in offering one's wares and ones
155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171
for sale: in the former case the price is regulated by the law of supply and demar
172 173 174 175 176 177 178 179 180 181 182 183 184 185 186
but in the latter case the price is arbitrary. Indeed I may be an autocrat a
188 189 190 191 192 193 194 195 196 197 198 199 200
stamp whatever value I will upon myself. I may imprint my services with
202 203 204 205 206 207 208 209 210 211 212
mental trade-mark of superiority and carefully store them away against
214 215 216 217 218 219 220 221 222 223 224 225 226 227
hour of made-to-measure customers, or I may throw myself upon the barg
228 229 230 231 232 233 234 235 236 237 238 239 240
counter to be fingered over by the basement crowd. Every man is first gr
242 243 244 245 246 247 248 249 250 251 252 253
or small according to his own calculation. Spiritual bankruptcy is always seve
254 255 256 257 258 259 260 261 262 263 264 265 266 267
days ahead of the sheriff. Our mental collapse is the result of a poor syst
269 270 271 272 273 274 275 276 277 278
of bookkeeping. We strike off our trial balance, having underscored s
280 281 282 283 284 285 286 287 288
liquidating liabilities, and overlooked important assets. People are willing
290 291 292 293 294 295 296 297 298 299 300 301 302
believe a self-helping man a going concern until he stops discounting his b
304 305 306 307 308 309 310 311 312 313 314 315
and begins to walk stoop-shouldered. Emerson said that the best lightni
316 317 318 319 320 321 322 323 324 325 326 327 328
rod for self-protection is one's spine. Indeed one's carriage is more than
330 331 332 333 334 335 336 337 338 339 340
incident in his credit. Men have telltale gaits like thoroughbreds and tr
342 343 344 345 346 347 348 349 350 351 352 353 354
horses. A careful banker would sooner look into your face than into your str
356 357 358 359 360 361 362 363 364 365 366 367 368 369
box, for if you have been serving the god of doubt, of personal distrust, th
371 372 373 374 375 376 377 378 379 380 381 382 383
things are pictured in your countenance, and are more eloquent to the man w
385 386 387 388
lends than coupon papers.
389 390 391 392 393 394 395 396 397 398 399 400 401 402
A man may lack the confidence of every banker in his community and yet
404 405 406 407 408 409 410 411 412 413 414
strongly underwritten if he has the security of his own soul.

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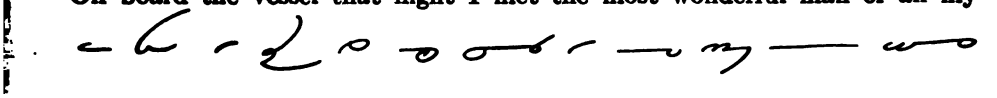
TEST B-2

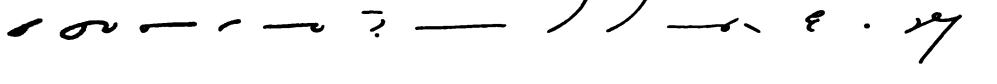
Eyes That See

On board the vessel that night I met the most wonderful man of all my

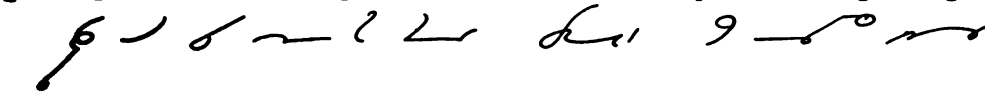


acquaintances. I cannot tell you his name for, indeed, I never knew him, and

yet I call him the most interesting man I have ever met. He was a steerage

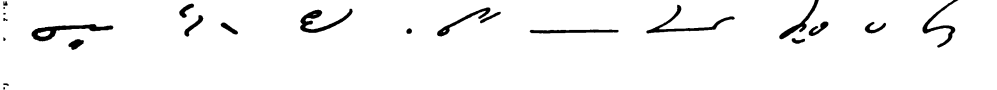


passenger and had come up from the bowels of the ship after midnight to get



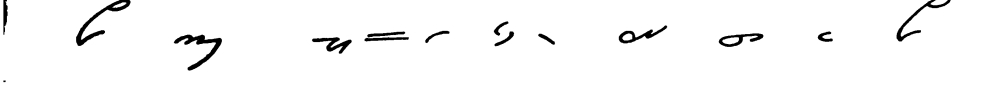
a few breaths of fresh air. I found that he was a billposter for one of our great

American circuses. He was not an educated man from the viewpoint of books,

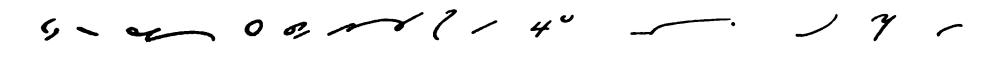


but he was a post graduate in the university of observation. He told me all

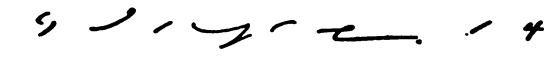
about the wonderful institution—the circus. I thought I knew all about the



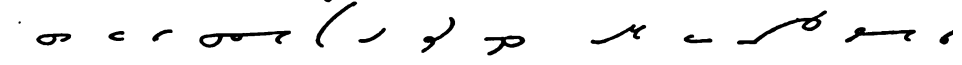
circus. Years ago I used to get up at four o'clock in the morning and watch the



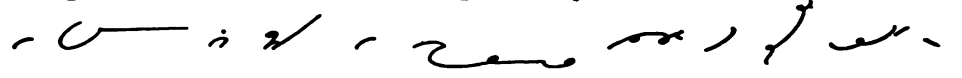
circus until it left the next morning at four. I thought I knew all about i



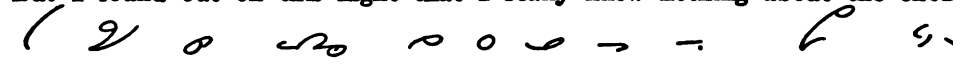
I knew all the animals by their first names, and was on intimate terms wi



the gentleman who issued the complimentary tickets for services rendere

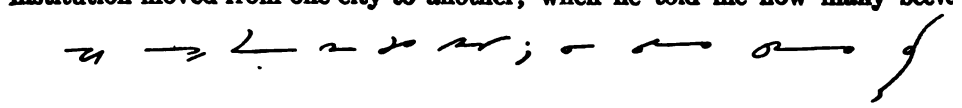


But I found out on this night that I really knew nothing about the circu

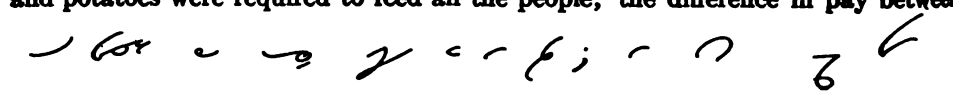


When this billposter told me the clock-like precision with which this grea

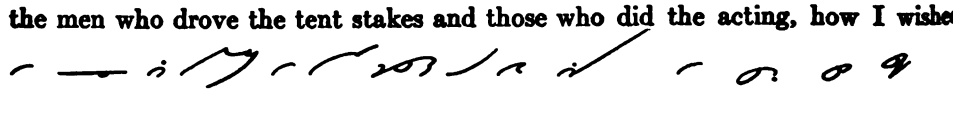
institution moved from one city to another; when he told me how many beeve



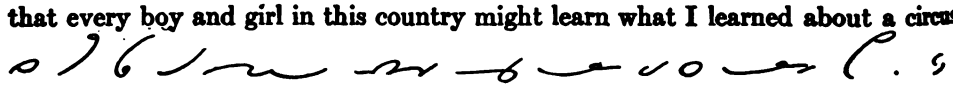
and potatoes were required to feed all the people; the difference in pay betwee



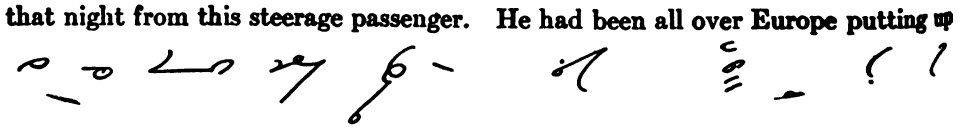
the men who drove the tent stakes and those who did the acting, how I wishe



that every boy and girl in this country might learn what I learned about a circu



that night from this steerage passenger. He had been all over Europe putting up



his circus bills, and everywhere he had been he had appropriated the treasures of

the old world. At two o'clock that morning, when I allowed this billposter to go

back to the steerage, I declared that that night had been far more entertaining

and profitable to me than any I had spent at Harvard University.

In bold contrast I recall the experience of a man who recently came into

my office in New York. He was applying for a stenographic position.

In reply to my query as to his education and experience he said that he had

graduated from one of our largest western universities, was a stenographer of

three years' experience, was thirty years of age, and desired fifteen dollars a week

Teacher's Key to Gregg Shorthand Test B-2

In scoring Test B-2 find the last word written by the pupil and refer to the following key to fin the number of that word. Divide by two to find the score in words per minute; mark this score o the pupil's paper and tally the same on the Class Record Sheet.

Eyes That See

1 2 3 4 5 6 7 8 9 10 11 12 13 14 1
On board the vessel that night I met the most wonderful man of all m
16 17 18 19 20 21 22 23 24 25 26 27 28 2
acquaintances. I cannot tell you his name for, indeed, I never knew him, an
30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45
yet I call him the most interesting man I have ever met. He was a steera
46 47 48 49 50 51 52 53 54 55 56 57 58 59
passenger and had come up from the bowels of the ship after midnight to g
61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78
a few breaths of fresh air. I found that he was a billposter for one of our gre
79 80 81 82 83 84 85 86 87 88 89 90 91
American circuses. He was not an educated man from the viewpoint of book
92 93 94 95 96 97 98 99 100 101 102 103 104 105 1
but he was a post graduate in the university of observation. He told me a
107 108 109 110 111 112 113 114 115 116 117 118 11
about the wonderful institution—the circus. I thought I knew all about th
120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 13
circus. Years ago I used to get up at four o'clock in the morning and watch th
137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 1
circus until it left the next morning at four. I thought I knew all about it.
154 155 156 157 158 159 160 161 162 163 164 165 166 167 16
knew all the animals by their first names, and was on intimate terms with th
169 170 171 172 173 174 175 176 177 178 1
gentleman who issued the complimentary tickets for services rendered. But
180 181 182 183 184 185 186 187 188 189 190 191 192 19
found out on this night that I really knew nothing about the circus. Whe
194 195 196 197 198 199 200 201 202 203 204 205 206
this billposter told me the clock-like precision with which this great institutio
207 208 209 210 211 212 213 214 215 216 217 218 219 220 221
moved from one city to another; when he told me how many beeves and potato
222 223 224 225 226 227 228 229 230 231 232 233 234 235 23
were required to feed all the people; the difference in pay between the men wh
237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 25
drove the tent stakes and those who did the acting, how I wished that every bo
253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 26
and girl in this country might learn what I learned about a circus that night fro
269 270 271 272 273 274 275 276 277 278 279 280 281 28
this steerage passenger. He had been all over Europe putting up his circus bill
283 284 285 286 287 288 289 290 291 292 293 294 295 29
and everywhere he had been he had appropriated the treasures of the old world
297 298 299 300 301 302 303 304 305 306 307 308 309 310 3
At two o'clock that morning, when I allowed this billposter to go back to th
312 313 314 315 316 317 318 319 320 321 322 323 32
steerage, I declared that that night had been far more entertaining and profitabl
325 326 327 328 329 330 331 332 333 334
to me than any I had spent at Harvard University.
335 336 337 338 339 340 341 342 343 344 345 346 347 3
In bold contrast I recall the experience of a man who recently came int
349 350 351 352 353 354 355 356 357 358 359 360 361 36
my office in New York. He was applying for a stenographic position. In repl
363 364 365 366 367 368 369 370 371 372 373 374 375 376 377
to my query as to his education and experience he said that he had graduate
378 379 380 381 382 383 384 385 386 387 388 389 39
from one of our largest western universities, was a stenographer of three year
391 392 393 394 395 396 397 398 399 400 401 402
experience, was thirty years of age, and desired fifteen dollars a week.

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CLASS RECORD SHEET

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To be used with Series B Tests in Gregg Shorthand.

.....State.....Date.....

ol.....Teacher.....Grade.....

Test used was of the Series B, Number.....

This class has studied shorthand.....weeks

re	Tally	No. of Pupils
00		
90		
80		
70		
60		
50		
40		
30		
20		
10		
00		
00		
00		
70		
00		
50		
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30		
20		
0		

General Directions

Tests of the Series B–1, B–2, are designed to measure not the quality of shorthand notes (for which a scale is being prepared), but the speed of writing shorthand when the correct outlines are given. These tests will not measure the pupil's knowledge of the system. Other tests will be prepared for that purpose.

Directions for scoring are given with the Teacher's Key. Find the last word written by the pupil. Get the number of this word from the key. Divide by two to get the score in words per minute. Place this score on pupil's paper and a tally mark opposite the group within which the score falls. When all papers have been scored, these tallies should be counted and the total extended to the last column, under *No. of Pupils*.

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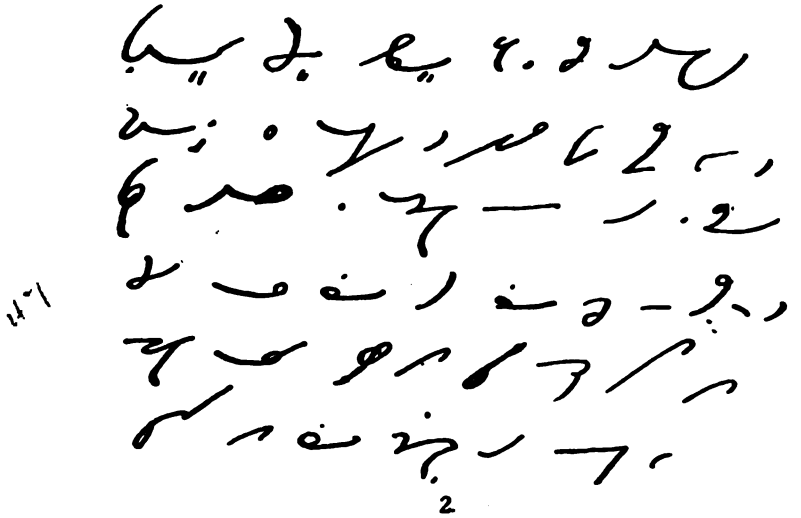
KEY TO THE TEXT OF THE 40 SPECIMENS OF SHORTHAND

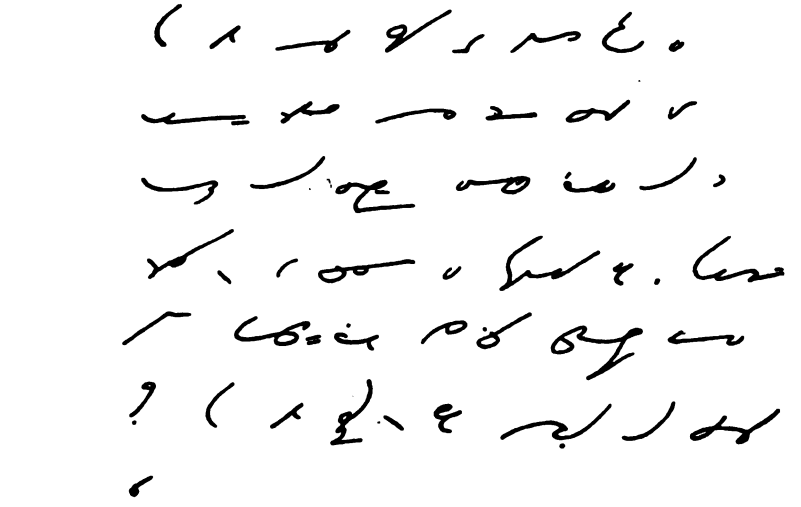
1.

Balt Van Tassel was an easy, indulgent soul. He loved his daughter better even than his pipe, and, like a reasonable man and an excellent father, let her have her way in everything. His notable little wife, too, had enough to do to attend to her housekeeping and manage the



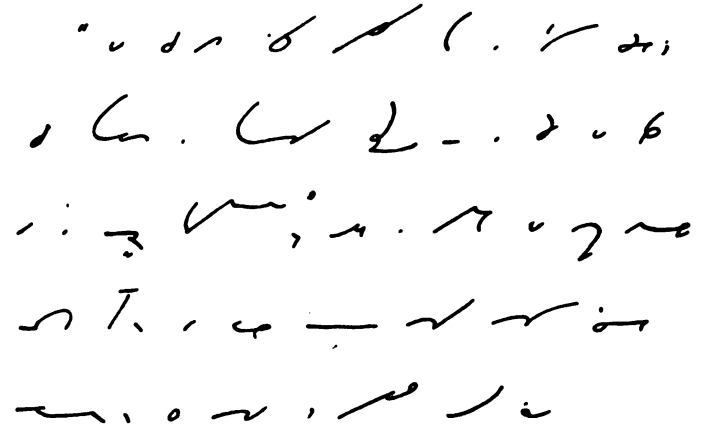
2

But it is meet I should, in the true spirit of romantic story, give some account of the looks and equipments of my hero and his steed. The animal he bestrode was a broken-down plow-horse, that had outlived almost everything but his viciousness. He was gaunt and shagged, with



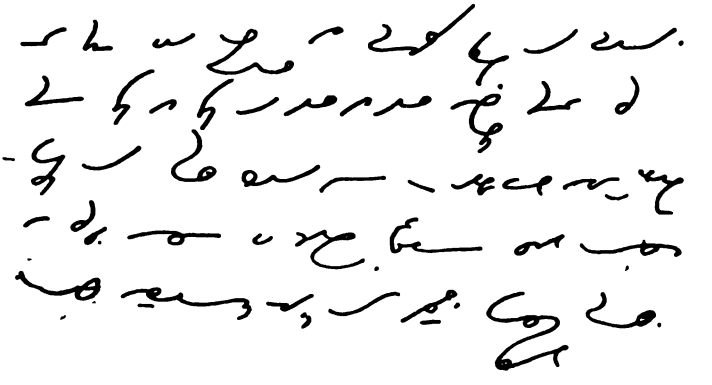
3.

Oh, she too had died but a short time since. She broke a blood-vessel in a fit of passion at a New England peddler. There was a drop of comfort, at least, in this intelligence. The honest man could contain himself no longer. He caught his daughter and her



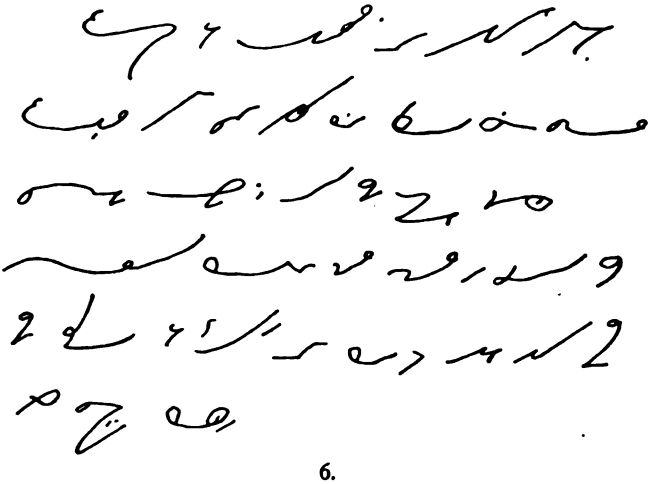
4.

In the fullness of their revelry, they fluttered, chirping and frolicking, from bush to bush, and tree to tree, capricious from the very profusion and variety around them. There was the honest cock-robin, the favorite game of stripling sportsmen, with its loud, querulous note; and the twittering blackbirds flying



5.

A sloop was loitering in the distance, dropping slowly down with the tide, her sail hanging uselessly against the mast; and, as the reflection of the sky gleamed along the still water, it seemed as if the vessel was suspended in the air. It was toward evening that Ichabod arrived



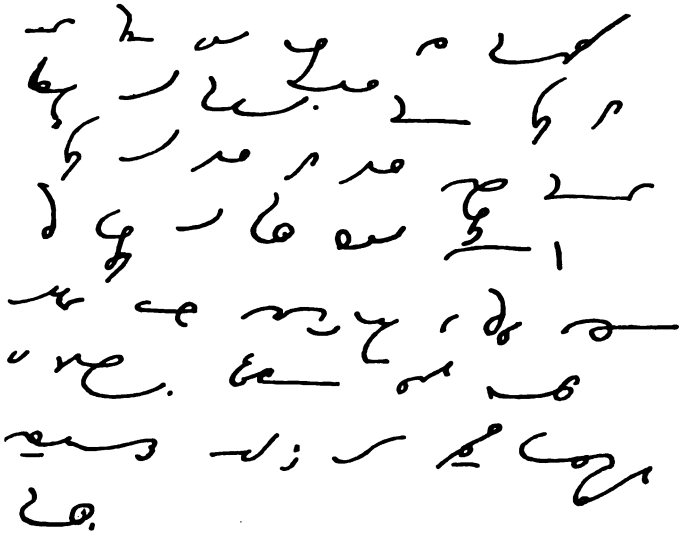
6.

How solemnly they would listen to the contents, as drawled out by Derrick Van Bummel, the schoolmaster,—a dapper, learned little man, who was not to be daunted by the most gigantic word in the dictionary; and how sagely they would deliberate upon public events some months after they had

(For this specimen see quality 30 on the scale.)

7.

In the fullness of their revelry, they fluttered, chirping and frolicking, from bush to bush, and tree to tree, capricious from the very profusion and variety around them. There was the honest cock-robin, the favorite game of stripling sportsmen, with its loud, querulous note; and the twittering blackbirds flying



8.

Just sufficient time had elapsed to enable each story-teller to dress up his tale with a little becoming fiction, and, in the indistinctness of his recollection, to make himself the hero of every exploit. There was the story of Doffue Martling, a large, blue-bearded Dutchman, who had nearly taken

(For this specimen see quality 35 on the scale.)

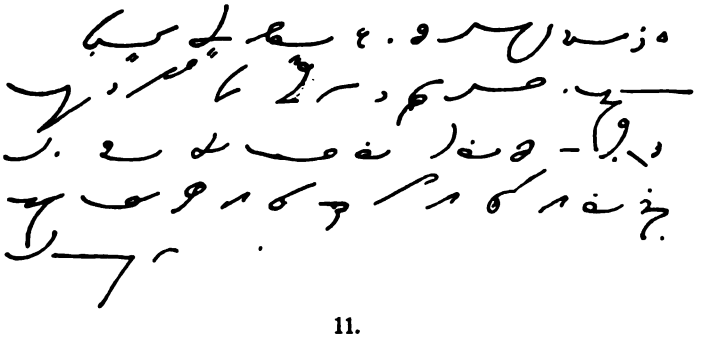
9.

Your mere puny stripling, that winced at the least flourish of the rod, was passed by with indulgence; but the claims of justice were satisfied by inflicting a double portion on some little, tough, wrong-headed, broad-skirted Dutch urchin, who sulked and swelled and grew dogged and sullen beneath

(For this specimen see quality 45 on the scale.)

10.

Balt Van Tassel was an easy, indulgent soul. He loved his daughter better even than his pipe, and, like a reasonable man and an excellent father, let her have her way in everything. His notable little wife, too, had enough to do to attend to her housekeeping and manage the



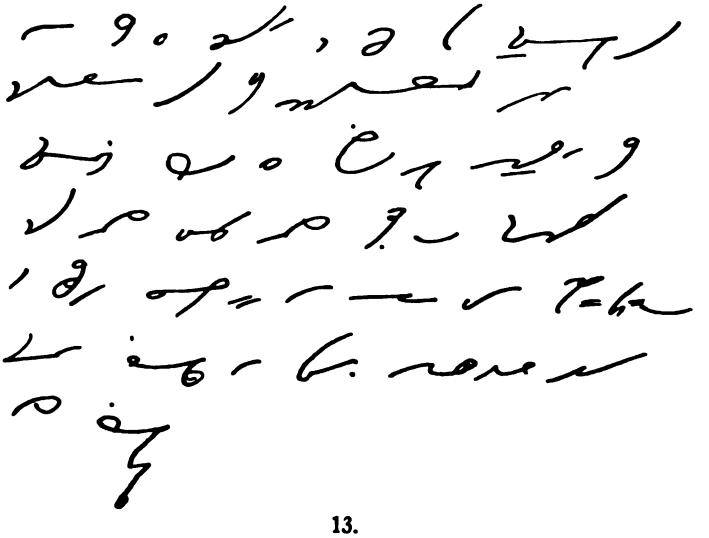
11.

But the thought and feeling embodied in the words of great writers during the so-called classic days of Greece and Rome are truly and splendidly alive today for the simple reason that they were alive then; and are so true to the universal experience of mankind and so beautiful in (50) their expression that Time cannot touch them nor age wither their "infinite variety,"

(For this specimen see quality 95 on the scale.)

12.

Then, as he wended his way, by swamp and stream and awful woodland, to the farmhouse where he happened to be quartered, every sound of nature, at that witching hour, fluttered his excited imagination, the moan of the whip-poor-will from the hillside; the boding cry of the tree-toad, that harbinger



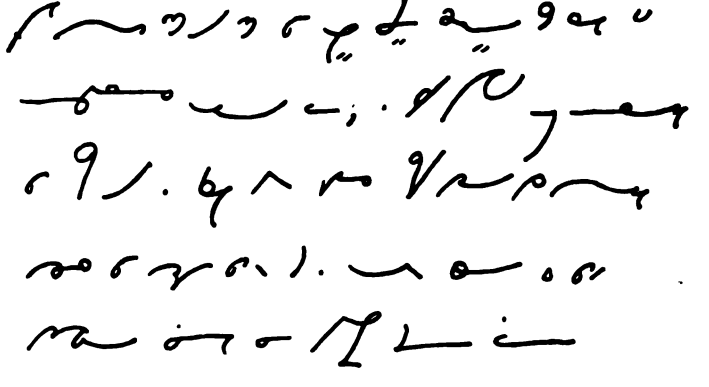
13.

Brom Bones, however, was the hero of the scene, having come to the gathering on his favorite steed Daredevil, a creature, like himself, full of mettle and mischief, and which no one but himself could manage. He was, in fact, noted for preferring vicious animals, given to all kinds of

(For this specimen see quality 60 on the scale.)

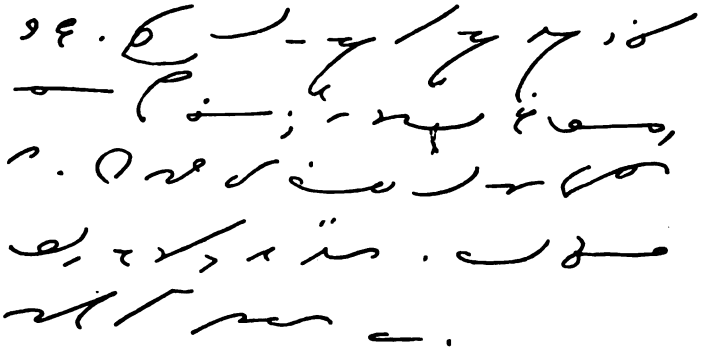
14.

Times grew worse and worse with Rip Van Winkle as years of matrimony rolled on. A tart temper never mellows with age, and a sharp tongue is the only edged tool that grows keener with constant use. For a long while he used to console himself, when driven from home



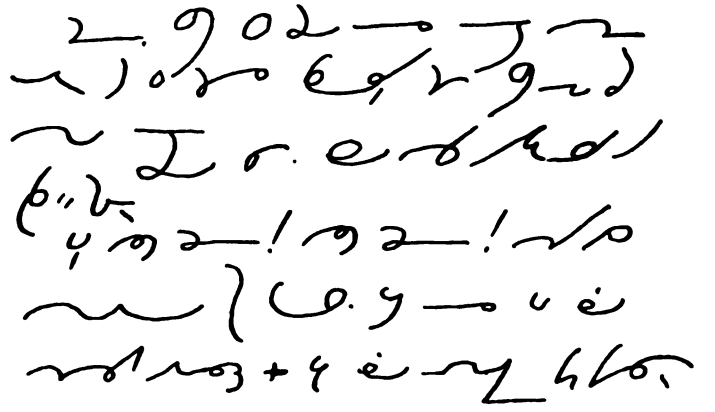
15.

As he was a bachelor, and in nobody's debt, nobody troubled his head any more about him. The school was removed to a different quarter of the hollow, and another pedagogue reigned in his stead. It is true, an old farmer, who had been down to New York on a



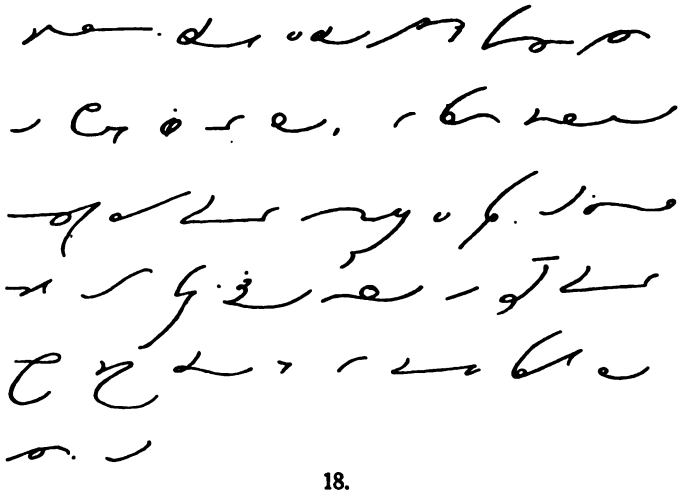
16.

Something, however, I fear me, must have gone wrong; for he certainly sallied forth, after no very great interval, with an air quite desolate and chopfallen. Oh these women, these women! Could that girl have been playing off any of her coquettish tricks? Was her encouragement of the poor pedagogue



17.

Streaming files of wild ducks began to make their appearance high in the air. The bark of the squirrel might be heard from the groves of beech and hickory nuts, and the pensive whistle of the quail at intervals from the neighboring stubble-field. The small birds were taking their



18.

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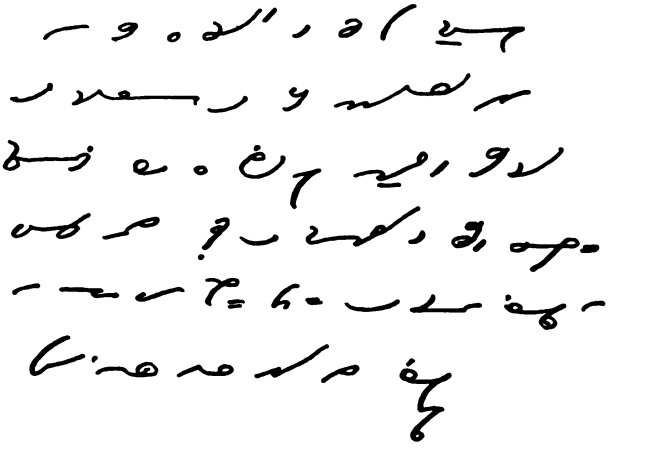
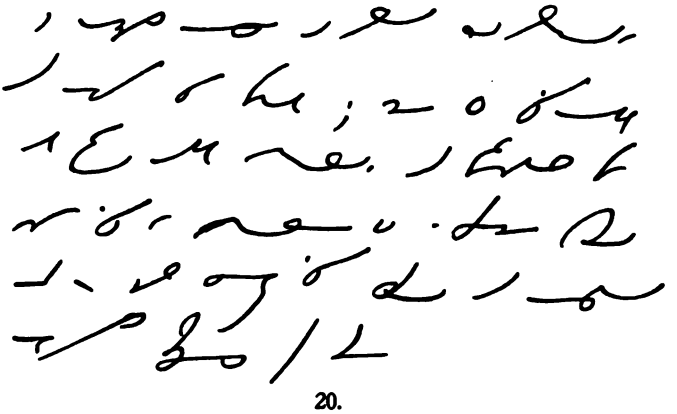


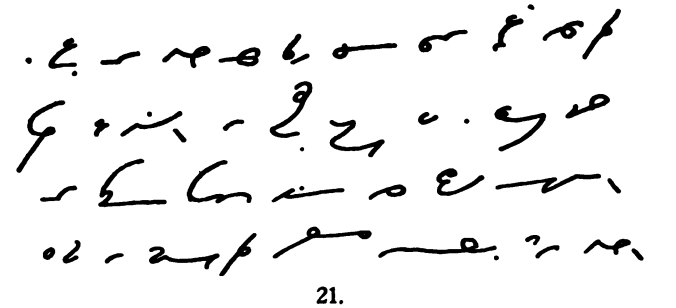
19.

His rusty mane and tail were tangled and knotted with burrs. One eye had lost its pupil, and was glaring and spectral, but the other had the gleam of a genuine devil in it. Still he must have had fire and mettle in his day, if we may judge from



20.

An opening in the trees now cheered him with the hopes that the church bridge was at hand. The wavering reflection of a silver star in the bosom of the brook told him that he was not mistaken. He saw the walls of the church dimly glaring under the trees



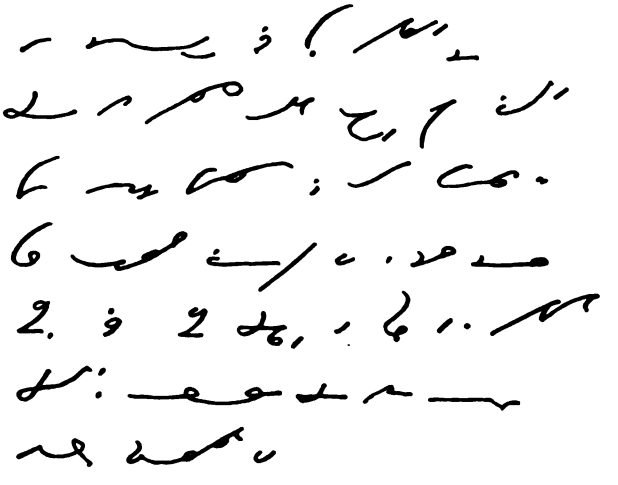
21.

This story was immediately matched by a thrice marvelous adventure of Brom Bones, who made light of the Galloping Hessian as an arrant jockey. He affirmed that, on returning one night from the neighboring village of Sing Sing, he had been overtaken by this midnight trooper; that he had offered

(For this specimen see quality O on the scale.)

22.

The schoolhouse, being deserted, soon fell to decay, and was reported to be haunted by the ghost of the unfortunate pedagogue; and the plow-boy, loitering homeward of a still summer evening, has often fancied his voice at a distance, chanting a melancholy psalm tune among the tranquil solitudes of



23.

There are three sorts of actions: those that are good, those that are bad, and those that are doubtful, and we ought to be cautious of those that are doubtful; for we are in most danger of these doubtful actions, because they do not alarm us, and yet they insensibly (50) lead to greater transgressions, just as the shades of twilight gradually reconcile us to darkness.

(For this specimen see quality 85 on the scale.)

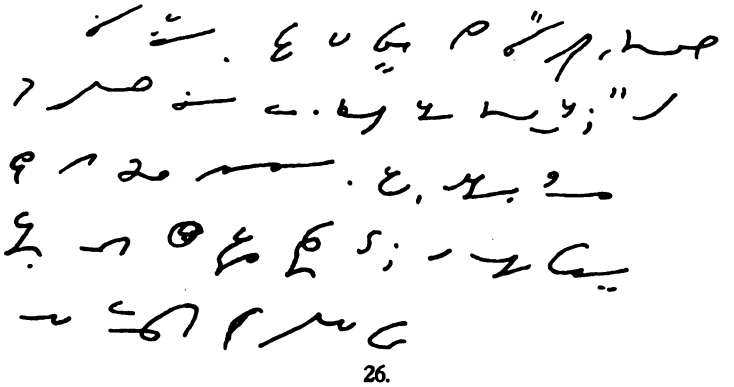
24.

The opinions of this junto were completely controlled by Nicholas Vedder, a patriarch of the village, and landlord of the inn, at the door of which he took his seat from morning till night, just moving sufficiently to avoid the sun, and keep in the shade of a large tree

(For this specimen see quality 80 on the scale.)

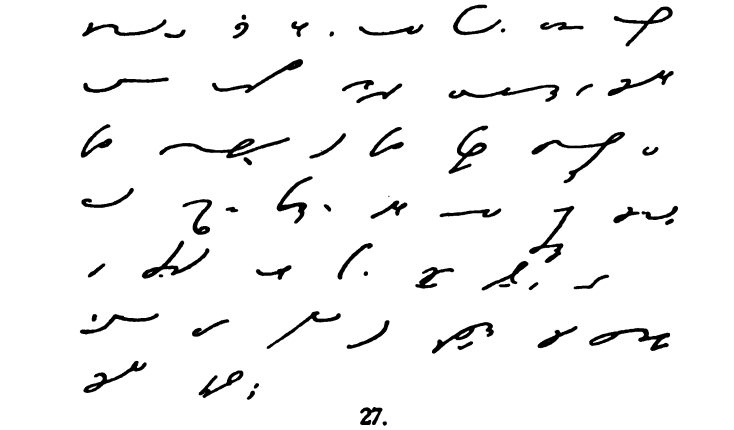
25.

He had overheard the boast of Bones, that he would "double the schoolmaster up and put him on a shelf;" and he was too wary to give him an opportunity. There was something extremely provoking in this obstinately pacific system; it left Brom no alternative but to draw upon the



26.

His schoolhouse was a low building of one large room, rudely constructed of logs; the windows partly glazed, and partly patched with leaves of old copy-books. It was most ingeniously secured at vacant hours by a withe twisted in the handle of the door, and stakes set against the window-shutters;



27.

As to Rip's son and heir, who was the ditto of himself, seen leaning against the tree, he was employed to work on the farm, but evinced an hereditary disposition to attend to anything else but his business. Rip now resumed his old walks and habits. He soon found many

(For this specimen see quality 75 on the scale.)

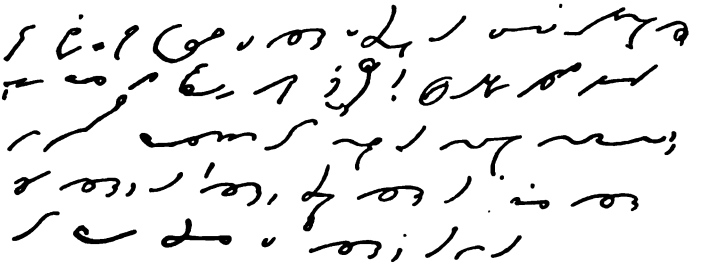
28.

The poor fellow was now completely confounded. He doubted his own identity, and whether he was himself or another man. In the midst of his bewilderment, the man in the cocked hat demanded who he was, and what was his name. "God knows!" exclaimed he, at his wits' end. "I'm

(For this specimen see quality 70 on the scale.)

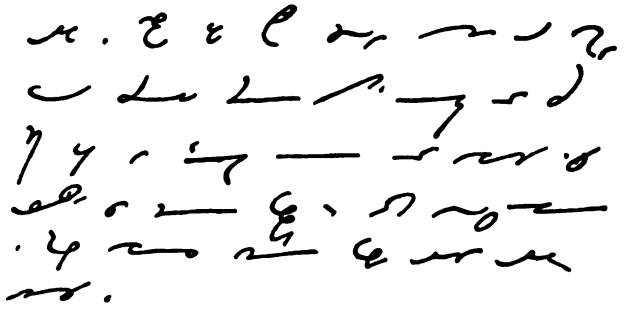
29.

Such heaped-up platters of cakes of various and almost indescribable kinds, known only to experienced Dutch housewives! There was the doughty doughnut, the tender oly-koek, and the crisp and crumbling cruller; sweet cakes and short cakes. ginger cakes and honey cakes, and the whole family of cakes; and then there



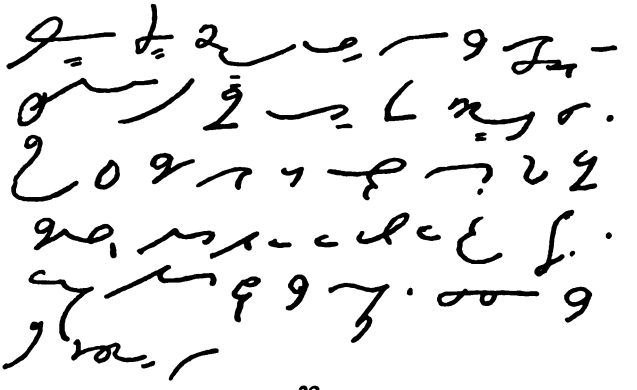
30.

There was a whisper, also, about securing the gun, and keeping the old fellow from doing mischief, at the very suggestion of which the self-important man in the cocked hat retired with some precipitation. At this critical moment a fresh, comely woman pressed through the throng to get a



31.

Dame Van Winkle regarded them as companions in idleness, and even looked upon Wolf with an evil eye, as the cause of his master's going so often astray. True it is, in all points of spirit befitting an honorable dog, he was as courageous an animal as ever scoured the



32.

Certain it is, the place still continues under the sway of some witching power, that holds a spell over the minds of the good people, causing them to walk in a continual revere. They are given to all kinds of marvelous beliefs; are subject to trances and visions; and frequently

(For this specimen see quality 90 on the scale.)

33.

They are like those little nooks of still water which border a rapid stream, where we may see the straw and bubble riding quietly at anchor, or slowly revolving in their mimic harbor, undisturbed by the rush of the passing current. Though many years have elapsed since I trod the

(For this specimen see quality 50 on the scale.)

34.

Fain would I pause to dwell upon the world of charms that burst upon the enraptured gaze of my hero, as he entered the state parlor of Van Tassel's mansion; not those of the bevy of buxom lasses, with their luxurious display of red and white, but the ample charms

(For this specimen see quality 55 on the scale.)

35.

He assisted the farmers occasionally in the lighter labors of their farms, helped to make hay, mended the fences, took the horses to water, drove the cows from pasture, and cut wood for the winter fire. He laid aside, too, all the dominant dignity and absolute sway with which he

(For this specimen see quality 25 on the scale.)

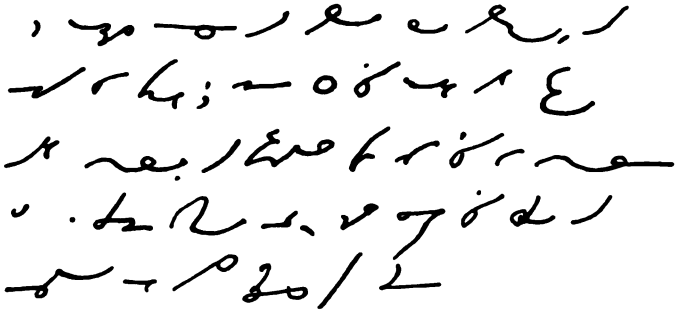
36.

The gallant Ichabod now spent at least an extra half hour at his toilet, brushing and furbishing up his best and indeed only suit of rusty black, and arranging his looks by a bit of broken looking-glass that hung up in the schoolhouse. That he might make his appearance

(For this specimen see quality 40 on the scale.)

37.

His rusty mane and tail were tangled and knotted with burrs. One eye had lost its pupil, and was glaring and spectral, but the other had the gleam of a genuine devil in it. Still he must have had fire and mettle in his day, if we may judge from



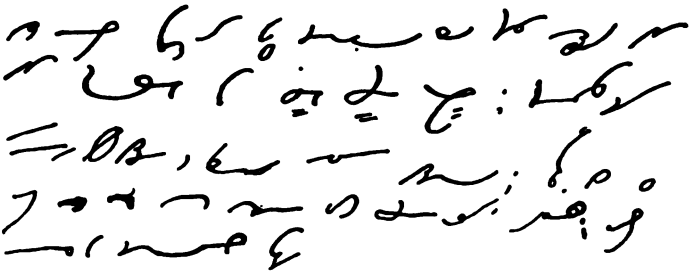
38.

"I am your father!" cried he,—"young Rip Van Winkle once, old Rip Van Winkle now! Does anybody know poor Rip Van Winkle?" All stood amazed, until an old woman, tottering out from among the crowd, put her hand to her brow, and, peering under it in his face for a

(For this specimen see quality 65 on the scale.)

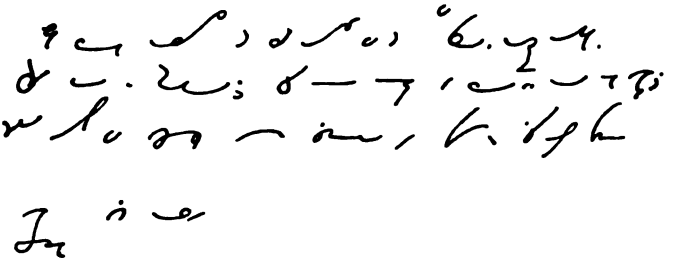
39.

These magic books and the poetic scrawl were forthwith consigned to the flames by Hans Van Ripper, who from that time forward determined to send his children no more to school, observing that he never knew any good come of this same reading and writing. Whatever money the schoolmaster possessed



40.

He was always ready for either a fight or a frolic; had more mischief than ill will in his composition; and, with all his overbearing roughness, there was a strong dash of waggish good-humor at bottom. He had three or four boon companions of his own stamp, who regarded



CLASS RECORD SHEET

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To be used with the MEASURING SCALE FOR SHORTHAND PENMANSHIP

City..... State..... Date.....

School..... Teacher..... Grade....

See other side for directions.

This class has studied shorthand ..... weeks.

Score for Quality	Score for speed in words per minute														
	0–10	11–20	21–30	31–40	41–50	51–60	61–70	71–80	81–90	91–100	101–110	111–120	121–130	131–140	141–150
95															
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30															
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under 25															
Totals															

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95															
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30															
25															
under 25															
Totals															

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DIRECTIONS

Write the following sentence on the blackboard *in shorthand:*

"Fourscore[1] and[2] seven[3] years[4] ago[5] our[6] fathers[7] brought[8] forth[9] upon[10] this[11] continent[12] a[13] new[14] nation,[15] conceived[16] in[17] liberty,[18] and[19] dedicated[20] to[21] the[22] proposition[23] that[24] all[25] men[26] are[27] created[28] equal."[29]

Have the pupils write this three times for practice, to familiarize them with the text and the shorthand. Collect these papers.

See to it that all have paper and two pencils (or fountain pen). Then say: "DO NOT WRITE ANYTHING UNTIL I GIVE YOU THE SIGNAL TO START. YOU WILL HAVE THREE MINUTES IN WHICH TO WRITE THE SENTENCE AS OFTEN AS YOU CAN. BE CAREFUL TO WRITE AS WELL AS YOU CAN. YOU WILL BE RATED BOTH FOR SPEED AND FOR QUALITY. START AND STOP PROMPTLY WHEN THE SIGNALS ARE GIVEN. ALL READY. START!" Keep the time very carefully, using a watch with a second-hand, allowing *exactly* three minutes. "STOP!" Collect the papers.

The score for speed is ascertained by multiplying 29 by the number of times the sentence has been completely written, adding the number of the last word written. This is the total number of words written and should be divided by three to get the score for speed in words per minute. Write this score in the upper right-hand corner of the paper.

When all have been scored in this way, score the papers for quality by the use of the scale, writing this score under the score for speed.

Enter the scores on the class record sheet by making a tally-mark in the square under the proper score for speed and opposite the score for quality. Total these scores both ways.

Pupil's Score
Total 150
Wrong
Right

A SERIES OF TESTS IN GREGG SHORTHAND

Arranged By Elmer Hoke, A. M.

TEST C-1 *Vocabulary*

Published by

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New York Chicago Boston San Francisco London

Name.....Age.....
Years Month

Race.....Sex.....Grade.....

City.....State.....Date.....

School.....Teacher.....

How long have you studied Gregg Shorthand?.....Month

Directions for Giving Test

1. Distribute papers face up on the desks. Ask pupils not to open papers until the signal is given.

2. Have pupils fill in blanks on the cover page.

3. Then say: "On the inside of this folder are 100 common words and 50 common phrases, with a space opposite each. You are to write in these spaces the shorthand outlines for the accompanying words and phrases. Accuracy is as important as speed. Work as fast as you can do it correctly. When I say, 'Ready, Start,' you may begin work. You will be given enough time to finish the work."

4. Give the signal to begin work and collect the papers as they are finished.

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Note.—The first pages of the other nine tests of the C series are identical with this, and will therefore not be given. Tests C-2 to C-10 follow immediately after this test, C-1.

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26. place	
27. every	
28. wind	
29. glad	
30. glass	
31. only	
32. Friday	
33. reach	
34. try	
35. clean	
36. these	
37. cent	
38. began	
39. stop	
40. turn	
41. date	
42. world	
43. once	
44. nothing	
45. order	
46. beside	
47. born	
48. enter	
49. speak	
50. off	

51. understand	
52. office	
53. money	
54. offer	
55. wonder	
56. write	
57. broke	
58. April	
59. January	
60. doctor	
61. fifth	
62. retire	
63. proper	
64. personal	
65. company	
66. board	
67. until	
68. getting	
69. beautiful	
70. fortune	
71. department	
72. clerk	
73. destroy	
74. desire	
75. employ	

76. crowd	
77. measure	
78. running	
79. information	
80. enclose	
81. statement	
82. neighbor	
83. drown	
84. illustrate	
85. common	
86. effect	
87. Christmas	
88. arrive	
89. marriage	
90. piece	
91. volume	
92. concern	
93. refer	
94. earliest	
95. expense	
96. material	
97. citizen	
98. session	
99. extreme	
100. preliminary	

101. of the	
102. yours very truly	
103. I have	
104. there is	
105. of our	
106. there are	
107. and company	
108. to give	
109. five thousand	
110. to get	
111. at least	
112. we shall be	
113. of them	
114. they were	
115. we would	
116. I think	
117. I know	
118. to send	
119. under the	
120. some of the	
121. that are	
122. to meet	
123. that you	
124. to place	
125. of that	

126. to find	
127. to my	
128. we had	
129. to his	
130. have you	
131. we have not	
132. no doubt	
133. have the	
134. which was	
135. he does	
136. with regard to	
137. on it	
138. of this kind	
139. in making	
140. along the	
141. two or three	
142. in which the	
143. you do not	
144. my dear sir	
145. we are not	
146. give us	
147. we shall take pleasure	
148. dear doctor	
149. might be	
150. to put	

TEST C-2

1. do		26. report	
2. see		27. under	
3. top		28. print	
4. us		29. with	
5. but		30. party	
6. look		31. where	
7. over		32. hour	
8. kill		33. better	
9. child		34. move	
10. door		35. spell	
11. law		36. club	
12. then		37. night	
13. if		38. able	
14. ran		39. walk	
15. tree		40. lesson	
16. river		41. road	
17. end		42. country	
18. came		43. own	
19. Mr.		44. ground	
20. west		45. third	
21. forget		46. teach	
22. blue		47. goes	
23. rest		48. railroad	
24. read		49. past	
25. large		50. true	

follow	
great	
ready	
suffer	
tire	
expect	
feel	
history	
mean	
hear	
eight	
refuse	
judge	
everything	
quite	
September	
madam	
don't	
flight	
empire	
obtain	
though	
newspaper	
nearly	
property	

76. factory	
77. famous	
78. allow	
79. whom	
80. await	
81. perhaps	
82. weigh	
83. adopt	
84. different	
85. diamond	
86. distribute	
87. interest	
88. supply	
89. further	
90. certain	
91. organize	
92. associate	
93. minute	
94. whether	
95. responsible	
96. suggest	
97. necessary	
98. secretary	
99. practical	
100. disappoint	

101. in the	
102. that the	
103. from the	
104. of his	
105. have been	
106. you are	
107. in which	
108. one of the	
109. you know	
110. to me	
111. you would	
112. if you are	
113. very much	
114. to go	
115. through the	
116. we enclose	
117. in order	
118. and in	
119. we do not	
120. that will	
121. who are	
122. you will be	
123. to him	
124. to receive	
125. thank you for	

126. to have you	
127. to them	
128. we should like	
129. to serve	
130. he could	
131. who had	
132. on account of	
133. he did	
134. why not	
135. he should	
136. would not	
137. should have	
138. sometime ago	
139. it would be	
140. as it is	
141. when they	
142. they will	
143. your account	
144. please let	
145. we beg	
146. in this country	
147. we should be glad	
148. every day	
149. more or less	
150. up the	

TEST C-3

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26. never	
27. most	
28. air	
29. mine	
30. upon	
31. week	
32. wife	
33. water	
34. delay	
35. poor	
36. seen	
37. pass	
38. gone	
39. grant	
40. half	
41. March	
42. meet	
43. before	
44. lead	
45. push	
46. happen	
47. hold	
48. unable	
49. might	
50. took	

51. charge	
52. Miss	
53. omit	
54. built	
55. pair	
56. need	
57. sure	
58. cause	
59. vote	
60. size	
61. afraid	
62. district	
63. weather	
64. rate	
65. none	
66. station	
67. truly	
68. Thursday	
69. travel	
70. mayor	
71. family	
72. o'clock	
73. daughter	
74. sometimes	
75. select	

76. publish	
77. serve	
78. position	
79. arrest	
80. suppose	
81. their	
82. wear	
83. secure	
84. object	
85. together	
86. general	
87. often	
88. assist	
89. serious	
90. witness	
91. summon	
92. automobile	
93. ought	
94. distinguish	
95. beginning	
96. mere	
97. divide	
98. association	
99. proceed	
100. especially	

to the	
to you	
of this	
if you	
in this	
must be	
with your	
we will	
to see	
to say	
to this	
to know	
when the	
did not	
dear madam	
and have	
I should	
as to the	
we must	
we remain	
will not	
and is	
to that	
we have been	
would have	

126. was the	
127. we could	
128. are you	
129. to work	
130. I don't	
131. by you	
132. so much	
133. I believe	
134. with our	
135. in connection with	
136. any one	
137. to learn	
138. this morning	
139. let me	
140. by which	
141. yes sir	
142. to speak	
143. will have	
144. railroad company	
145. we have the	
146. is in	
147. we think	
148. for him	
149. my dear Mr.	
150. upon his	

TEST C-4

1. go		26. found	
2. the		27. made	
3. you		28. fill	
4. good		29. became	
5. all		30. two	
6. like		31. first	
7. make		32. state	
8. let		33. round	
9. play		34. pound	
10. low		35. finish	
11. just		36. felt	
12. year		37. shut	
13. her		38. suit	
14. that		39. soap	
15. got		40. father	
16. cut		41. next	
17. feet		42. another	
18. show		43. know	
19. thing		44. such	
20. told		45. point	
21. noon		46. begun	
22. town		47. drill	
23. son		48. ticket	
24. cannot		49. begin	
25. down		50. again	

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76. represent	
77. estate	
78. field	
79. themselves	
80. wonderful	
81. imprison	
82. entertain	
83. honor	
84. provision	
85. convention	
86. tomorrow	
87. stopped	
88. difference	
89. doubt	
90. investigate	
91. official	
92. various	
93. absence	
94. consideration	
95. application	
96. senate	
97. principal	
98. career	
99. cordially	
100. annual	

101. it is	
102. with the	
103. five per cent	
104. for you	
105. into the	
106. should be	
107. if the	
108. it will	
109. from you	
110. to take	
111. had been	
112. do not	
113. with us	
114. to keep	
115. for us	
116. and was	
117. at our	
118. we may	
119. we shall be glad	
120. we want	
121. about it	
122. at last	
123. we wish	
124. we regret	
125. and it is	

126. we are in	
127. who is	
128. by this	
129. we desire	
130. if it	
131. five hundred thousand dollars	
132. that it	
133. if not	
134. your favor	
135. in this way	
136. at the time	
137. to send you	
138. to become	
139. of what	
140. can you	
141. you could	
142. to those	
143. and not	
144. so far as	
145. we sent you	
146. is it	
147. we trust that	
148. from which	
149. shall have	
150. we receive	

TEST C-5

1. at	
2. in	
3. will	
4. little	
5. your	
6. six	
7. school	
8. big	
9. sea	
0. soft	
1. way	
2. to	
3. them	
4. his	
5. north	
6. song	
7. went	
8. Monday	
9. what	
0. best	
1. think	
2. stay	
3. help	
4. May	
5. why	

26. side	
27. said	
28. along	
29. brother	
30. they	
31. sent	
32. July	
33. cost	
34. behind	
35. hurt	
36. full	
37. easy	
38. track	
39. news	
40. anything	
41. indeed	
42. trip	
43. were	
44. many	
45. within	
46. collect	
47. army	
48. account	
49. contract	
50. inform	

51. member	
52. died	
53. front	
54. prove	
55. woman	
56. sorry	
57. himself	
58. copy	
59. dozen	
60. rather	
61. royal	
62. contain	
63. perfect	
64. remain	
65. between	
66. address	
67. enjoy	
68. repair	
69. beg	
70. Mrs.	
71. does	
72. reply	
73. engage	
74. firm	
75. except	

76. term	
77. remember	
78. ledge	
79. special	
80. direction	
81. written	
82. salary	
83. promise	
84. according	
85. increase	
86. consider	
87. motion	
88. examination	
89. condition	
90. therefore	
91. victim	
92. decide	
93. conference	
94. colonies	
95. difficulty	
96. receive	
97. testimony	
98. height	
99. character	
100. committee	

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ı soon as	
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126. we are sending you	
127. at any time	
128. for that	
129. you desire	
130. if they	
131. hear from you	
132. this matter	
133. in all	
134. you want	
135. I shall be	
136. call your attention	
137. to tell	
138. which are	
139. on that	
140. for some time	
141. you're	
142. trusting that	
143. at first	
144. there will be	
145. we should be pleased	
146. kindly let us	
147. will you please	
148. I don't know	
149. should not be	
150. with that	

TEST C-6

1. on		26. kind	
2. so		27. work	
3. we		28. lost	
4. ago		29. rain	
5. out		30. would	
6. boy		31. mile	
7. street		32. head	
8. mother		33. price	
9. day		34. around	
10. stand		35. maybe	
11. get		36. fail	
12. I		37. catch	
13. other		38. watch	
14. led		39. small	
15. white		40. table	
16. winter		41. four	
17. back		42. list	
18. yet		43. dead	
19. than		44. morning	
20. form		45. done	
21. sister		46. file	
22. grand		47. pretty	
23. hard		48. driven	
24. line		49. deal	
25. bill		50. both	

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76. section	
77. either	
78. claim	
79. women	
80. forward	
81. arrange	
82. visitor	
83. wreck	
84. already	
85. manner	
86. against	
87. theater	
88. particular	
89. government	
90. too	
91. estimate	
92. entitle	
93. Wednesday	
94. assure	
95. scene	
96. respectfully	
97. discussion	
98. organization	
99. separate	
100. decision	

101. dear sir	
102. five dollars	
103. very truly yours	
104. in your	
105. can be	
106. of course	
107. to our	
108. of it	
109. but the	
110. if you will	
111. upon the	
112. we hope	
113. I shall	
114. who have	
115. we shall be pleased	
116. in regard to	
117. if you can	
118. before the	
119. on this	
120. for which	
121. could be	
122. it is not	
123. is that	
124. what is	
125. give you	

126. we trust	
127. I'll	
128. he can	
129. and their	
130. in fact	
131. if there	
132. to secure	
133. I should like	
134. and make	
135. it has been	
136. I could	
137. to which	
138. with this	
139. ought to	
140. if we	
141. yours sincerely	
142. we shall have	
143. B. & O.	
144. they would	
145. we wrote you	
146. less than	
147. within the	
148. in this matter	
149. that the	
150. years ago	

TEST C-7

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26. life	
27. our	
28. name	
29. keep	
30. any	
31. seem	
32. story	
33. become	
34. burn	
35. across	
36. set	
37. black	
38. dash	
39. war	
40. high	
41. herself	
42. people	
43. leave	
44. however	
45. body	
46. provide	
47. stole	
48. real	
49. almost	
50. heart	

TEST C-8

1. it		26. here	
2. now		27. more	
3. my		28. room	
4. bad		29. start	
5. may		30. could	
6. by		31. even	
7. come		32. open	
8. land		33. class	
9. sit		34. camp	
10. bring		35. tonight	
11. much		36. stamp	
12. send		37. warm	
13. well		38. fell	
14. nine		39. summer	
15. foot		40. talk	
16. free		41. power	
17. paper		42. ever	
18. give		43. early	
19. very		44. mind	
20. gave		45. trust	
21. card		46. sight	
22. dark		47. income	
23. cover		48. recover	
24. ship		49. brought	
25. girl		50. month	

on the	
at the	
to make	
he was	
may be	
to have	
of their	
which is	
this is	
your order	
do you	
are not	
could not	
will you	
let us	
I would	
we believe	
in that	
to ask	
I was	
I've	
it is not	
it has	
which you	
I want	

126. as much	
127. in your letter	
128. I do not	
129. at the same time	
130. in my	
131. if this	
132. to sell	
133. send us	
134. at any	
135. last year	
136. if it is	
137. you cannot	
138. you see	
139. ten days	
140. in the future	
141. at present	
142. who can	
143. did you	
144. this is the	
145. with its	
146. on the other hand	
147. your attention	
148. in time	
149. the order	
150. you will have	

101. for the	
102. we have	
103. has been	
104. you can	
105. to do	
106. to us	
107. is not	
103. of these	
109. you may	
110. that this	
111. in his	
112. we cannot	
113. I can	
114. five hundred dollars	
115. to write	
116. that it is	
117. which the	
118. and are	
119. and brother	
120. after the	
121. I wish	
122. I will	
123. may have	
124. and our	
125. of my	

126. as they	
127. sincerely yours	
126. in addition	
129. at this time	
130. it would	
131. if you wish	
132. was not	
133. that it was	
134. at that	
135. to any	
136. in these	
137. by return mail	
138. at the present time	
139. that there	
140. in the past	
141. business men	
142. will you kindly	
143. f. o. b.	
144. to bring	
145. with reference to	
146. rather than	
147. your name	
148. is to be	
149. there's	
150. you will receive	

TEST C-9

1. is		26. car	
2. man		27. when	
3. up		28. hope	
4. red		29. mail	
5. into		30. should	
6. have		31. without	
7. hand		32. short	
8. cold		33. horse	
9. lot		34. bear	
10. tell		35. tenth	
11. call		36. light	
12. one		37. unless	
13. about		38. fight	
14. face		39. above	
15. blow		40. June	
16. lake		41. wish	
17. put		42. held	
18. new		43. close	
19. or		44. shall	
20. alike		45. extra	
21. south		46. stood	
22. band		47. bought	
23. fire		48. mountain	
24. train		49. less	
25. part		50. children	

51. return	
52. please	
53. else	
54. death	
55. always	
56. evening	
57. November	
58. person	
59. among	
60. October	
61. jail	
62. fourth	
63. instead	
64. duty	
65. enough	
66. through	
67. Tuesday	
68. auto	
69. carried	
70. visit	
71. view	
72. which	
73. known	
74. period	
75. command	

76. entire	
77. due	
78. Saturday	
79. justice	
80. attempt	
81. combination	
82. toward	
83. busy	
84. director	
85. service	
86. treasure	
87. total	
88. neither	
89. system	
90. circular	
91. accept	
92. recent	
93. folks	
94. probably	
95. circumstance	
96. majority	
97. evidence	
98. sincerely	
99. convenient	
100. recommend	

101. to be	
102. will be	
103. I am	
104. we can	
105. and that	
106. of all	
107. at once	
108. on your	
109. of which	
110. of its	
111. that they	
112. as to	
113. in reply	
114. he had	
115. you will find	
116. and will	
117. any other	
118. for it	
119. can not	
120. in such	
121. of time	
122. not only	
123. the other	
124. few days	
125. on his	

126. in any	
127. the time	
128. in order that	
129. do so	
130. of those	
131. in the world	
132. and see	
133. to call	
134. cannot be	
135. to their	
136. just as	
137. he cannot	
138. I can't	
139. this will	
140. on hand	
141. for their	
142. with which	
143. five pounds	
144. to come	
145. young man	
146. the whole	
147. and also	
148. I suppose	
149. they're	
150. you wish	

TEST C-10

1. she		26. word	
2. ten		27. from	
3. last		28. same	
4. of		29. eye	
5. him		30. city	
6. are		31. afternoon	
7. ring		32. lady	
8. hot		33. care	
9. box		34. clear	
10. five		35. sir	
11. long		36. coming	
12. has		37. clothing	
13. men		38. buy	
14. miss		39. express	
15. block		40. right	
16. page		41. because	
17. each		42. church	
18. letter		43. flower	
19. thank		44. alone	
20. add		45. dress	
21. deep		46. fix	
22. game		47. paid	
23. age		48. steamer	
24. saw		49. event	
25. still		50. build	

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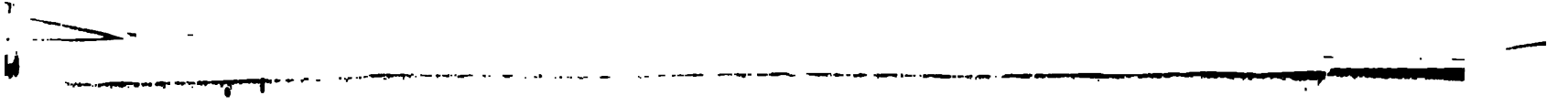
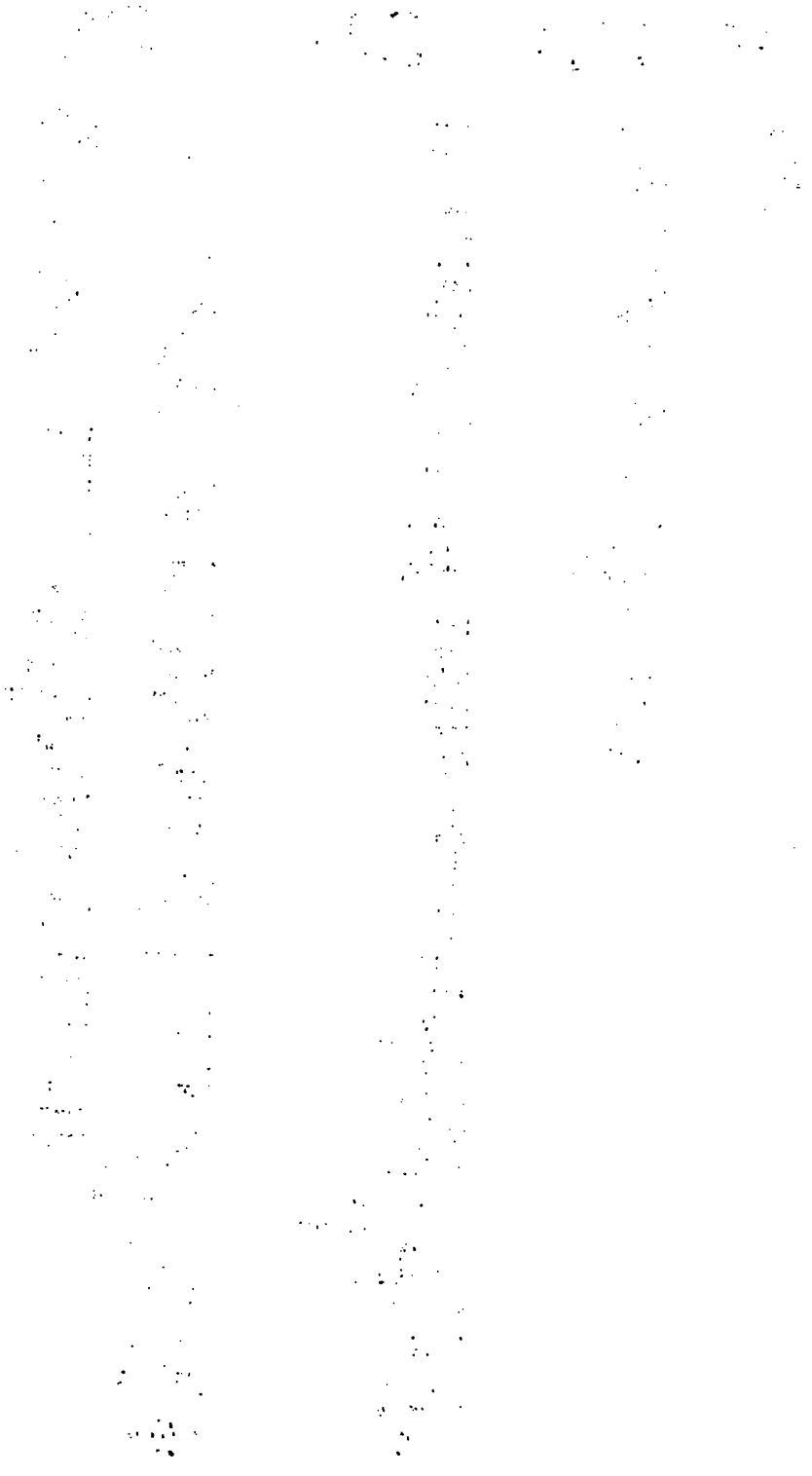
76. president	
77. include	
78. appoint	
79. gentleman	
80. whose	
81. avenue	
82. success	
83. prefer	
84. purpose	
85. injure	
86. popular	
87. mention	
88. local	
89. possible	
90. argument	
91. impossible	
92. business	
93. meant	
94. foreign	
95. issue	
96. elaborate	
97. experience	
98. athletic	
99. receipt	
100. allege	

101. we are	
102. of you	
103. you will	
104. is the	
105. as the	
106. you have	
107. that is	
108. there are	
109. more than	
110. he is	
111. he will	
112. United States	
113. five thousand dollars	
114. on our	
115. we should	
116. as you	
117. I had	
118. respectfully yours	
119. in its	
120. five hundred	
121. than the	
122. thank you	
123. that's	
124. to it	
125. from this	

126. shall be	
127. New York City	
128. to look	
129. send you	
130. has not	
131. we find	
132. it may be	
133. and they	
134. we feel	
135. from our	
136. who was	
137. of such	
138. in this case	
139. I do	
140. under separate cover	
141. to believe	
142. if you do not	
143. you did	
144. for these	
145. very glad	
146. better than	
147. to furnish	
148. as follows	
149. it must be	
150. to all	





THE IMPROVEMENT OF SPEED AND ACCURACY IN TYPEWRITING

THE JOHNS HOPKINS UNIVERSITY
STUDIES IN EDUCATION
No. 7

EDITED BY
EDWARD F. BUCHNER

THE IMPROVEMENT OF SPEED AND ACCURACY IN TYPEWRITING

BY
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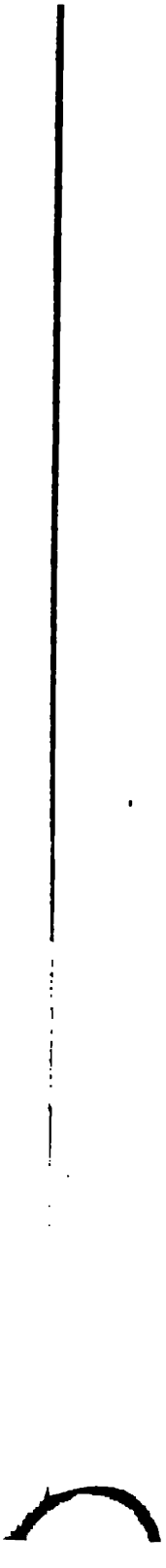
R. E. H.



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INTRODUCTION

Some time ago the writer began work on the problem of constructing standard tests in typewriting, such as have been and are being formulated for the various subjects of the elementary and secondary school curricula. The first preliminary investigations, however, revealed the fact that there were other typewriting problems which might logically claim priority. First, since typewriting is a matter entirely of the use of the letters of the alphabet and the various marks, it seemed necessary to investigate the frequency of the occurrence of these letters and marks in the English language. Secondly, since accuracy is one of the primary requisites of good typewriting, it appeared to be important to investigate the number and distribution of errors made in actual typewriting, and to learn, if possible, their causes. Third, the modern "touch" method of typewriting presumably makes equal demands upon all the fingers and upon the two hands. In fact, the typewriter keyboard is so arranged as to assign fifteen letters to the left hand, and only eleven to the right. The problem arises: what are the relative abilities of the eight fingers and the two hands. Fourth, the determination of the loads or burdens of work which the present typewriter keyboard places upon the fingers and hands. Fifth, an attempt to enumerate the considerations which must be taken into account in the arrangement of a keyboard according to scientific principles; a suggested keyboard, and the criticism of the same from the considerations set forth.

The field of this investigation is one that has not been cultivated. With the exception of the work by Book on "The Psychology of Skill," little or no experimentation has been done in typewriting. Even in Book's study, the object was not so much the improvement of speed, accuracy or methods of teaching typewriting, as it was the more general aim of ascertaining, by the use of the typewriter as a mere

bit of apparatus, the psychology of skill. Any other mechanism, an adding machine or piano for instance, would have been equally capable of use in a study of skill, though perhaps not equally convenient for experimental purposes.

I. THE FREQUENCY OF THE OCCURRENCE OF LETTERS AND MARKS IN THE ENGLISH LANGUAGE

The first objective of the problem under consideration is to determine the frequency with which the various letters of the alphabet and the more common marks are used in the English language. For this purpose valuable material was readily at hand as to the letters in the form of the Ayres Spelling Scale. This scale itself informs us that the 1,000 words in the list are "the product of combining different studies with the object of identifying the 1,000 commonest words in English writing." The scale was formed by combining four different vocabulary studies as follows: (1) A study by Ayres himself involving a total of 23,629 words found in personal and business letters. (2) The study of Eldridge comprising 43,989 words found on two pages each of four different newspapers. (3) The study of Rev. Knowles of London, of the vocabulary of the English Bible and various authors, to a total of 100,000 words. (4) The study of Cook and O'Shea of the vocabulary used by thirteen persons in family and social correspondence, including a total of 5,200 different words. Most of these words occurred a number of times. It will be seen, therefore, that the 1,000 words in the Ayres Scale are those that were found most frequently in approximately 368,000 words of personal letters, business letters, newspapers, the Bible, and various English authors.

Accepting the 1,000 words of this list as the most common in the English language, it would appear that by counting the frequency with which the various letters of the alphabet appear in these words, we should secure a very close approximation to their frequency in the English language in general, and in the work done on typewriters in particular.

Table I shows in the first column the gross number of occurrences of each letter of the alphabet in the 1,000 commonest words. A total of 5,433 letters were found. The average length of the words, therefore, is 5.433 letters. By multiplying the number of occurrences of each letter by

TABLE I

FREQUENCY OF USE OF LETTERS IN THE WORDS OF THE AYRES SPELLING SCALE

	Times Used	Raised to 1000	Percentage	Based on "Q"
E	734	1000	13.51	245
T	440	609	8.09	147
R	434	591	7.98	145
A	419	571	7.71	139
O	385	524	7.08	128
N	373	508	6.88	124
I	366	598	6.73	122
S	308	420	5.66	103
L	254	350	4.67	85
C	219	298	4.03	73
D	193	263	3.51	64
U	171	233	3.14	57
H	170	232	3.12	56
P	161	219	2.96	54
M	154	210	2.81	51
G	114	155	2.09	38
F	113	154	2.07	37
Y	107	146	1.96	36
B	97	132	1.78	32
W	90	123	1.65	30
V	60	82	1.09	20
K	36	49	.66	12
J	14	19	.25	5
X	13	18	.23	4
Z	5	7	.09	2
Q	3	4	.05	1
Total	5433	7415	100.%	1790

1.362 we secure the second column of the table, in which "E" is raised to 1,000. This was done so as to put each letter on a comparable basis. The third column shows the percentage of English writing that is made up by each letter of the alphabet. The fourth column gives the frequency of the letters with reference to "Q" as one. From this column it will be noted that for each use of the letter "Q," the letter "E" occurs 245 times.

Although the evidence thus secured for the frequencies of letters seemed almost conclusive, it was nevertheless thought desirable to support it by corroborative evidence from original studies. With this purpose in view, three studies were made on the frequencies of letters and punctuation marks in (1) the Gospel of St. Mark, (2) representative business letters, and (3) current newspaper editorials.

TABLE II

FREQUENCY OF USE OF LETTERS AND PUNCTUATION MARKS IN THE SIXTEENTH CHAPTER OF MARK'S GOSPEL

	Times Used	Raised to 1000
E	271	1000
T	164	605
A	155	572
H	153	565
N	106	391
S	92	340
D	92	340
O	88	325
I	87	321
R	67	247
L	63	232
Y	52	192
M	41	151
U	37	137
W	37	137
P	25	92
C	23	85
F	23	85
B	20	74
G	13	48
V	12	44
K	6	22
Z	3	11
J	2	7
Q	1	4
X	0	0
.	19	70
,	34	125
:	6	22
;	11	41

Table II shows the frequencies of use of letters and punctuation marks in the sixteenth chapter of Mark's Gospel. The first column shows the actual occurrences of letters, while the second column shows the same data with "E"

raised to 1,000 for purposes of comparison. This was done by multiplying the first column through by 3.69.

Table III shows the frequencies of use of letters and punctuation marks in actual business letters. The first column, again, shows the original data secured by count, while the second column shows the same data with "E" raised to 1,000 by multiplying through by 2.82.

TABLE III

FREQUENCY OF USE OF LETTERS AND PUNCTUATION MARKS IN BUSINESS LETTERS

	Times Used	Raised to 1000
E	354	1000
A	252	720
O	249	711
T	240	686
N	195	557
S	162	463
I	156	446
L	147	420
H	144	411
R	135	386
D	96	274
C	93	265
U	90	260
M	75	214
Y	72	205
B	51	146
W	48	137
P	33	94
G	30	86
V	24	69
F	18	51
K	12	34
X	9	25
J	6	17
Q	3	8
Z	3	8
.	44	124
,	49	140
:	4	12
;	0	0

Table IV shows the frequencies of use of letters and punctuation marks in a newspaper editorial both in the original form as counted and also as these data appear when raised to the basis of 1,000 for "E" by multiplying by 3.97.

A comparison of the data of these three original studies with Table I, which gives the frequency of letters only in the Ayres Spelling Scale, with the letter "E" raised to 1,000 for purposes of comparison, will reveal much similarity both

TABLE IV

FREQUENCY OF USE OF LETTERS AND PUNCTUATION MARKS IN A NEWSPAPER EDITORIAL

	Times Used	Raised to 1000
E	252	1000
A	219	876
T	210	841
S	180	723
O	171	685
I	168	673
R	117	468
N	105	420
H	102	409
L	99	396
B	72	289
C	69	276
U	66	263
P	57	228
M	54	216
D	42	169
Y	39	157
W	33	132
F	30	120
G	27	109
V	18	71
K	15	60
J	12	49
X	9	37
Q	6	24
Z	3	11
.	16	64
,	20	81
:	0	0
;	2	7

in the order or rank of the letters and in the four tables. It may justly be said that the differences in the four tables are less noticeable than the similarities. This fact may be given more definite and exact expression statistically. The frequencies of letters in the Ayres Scale correlate with the frequencies found by averaging the three original studies (Tables II, III and IV) almost perfectly. The coefficient

of correlation is .946 and the probable error is .012. The product-moment formula was used in securing this correlation.

It is of course possible that in any one study of the frequency of letters the chance presence or absence of a few words containing the less common letters, such as K, J, Q, X or Z, may appreciably influence the result. This difficulty

TABLE V

STUDIES ON THE FREQUENCY OF USE OF LETTERS AND PUNCTUATION MARKS

	Ayres	Mark	Business Letters	Editorial	Average
E	1000	1000	1000	1000	1000
T	609	605	686	841	685
A	571	572	720	876	684
O	524	325	711	685	561
S	420	340	463	723	486
I	498	321	446	673	484
N	508	391	557	420	469
R	591	247	386	468	423
H	232	565	411	409	402
L	350	232	420	396	349
D	263	340	274	169	261
C	298	85	265	276	231
U	233	137	260	263	223
M	210	151	214	216	198
Y	146	192	205	157	175
B	132	74	146	289	160
P	219	92	94	228	158
W	123	137	137	132	132
F	154	85	51	120	102
G	153	48	86	109	99
V	82	44	69	71	66
K	49	22	34	60	41
J	19	7	17	49	23
X	18	0	25	37	20
Q	4	4	8	24	10
Z	7	11	8	11	9
. .....		70	124	64	86
, ...		125	140	81	115
:		22	12	0	11
;		41	0	7	16

may be obviated by combining the four studies, to which procedure no objection may be raised in view of the very high correlation which obtains, as set forth above.

Table V shows the frequencies of letters and marks in the four studies made, all raised to the basis of 1,000 for "E,"

while in the fifth column of the table we have the average of the first four. This column is based on the counting of 12,130 letters of the alphabet in connection with the four studies. The findings set forth in this fifth column are accepted in this study as a basis for evaluating the various letters and marks and their importance or frequency in typewriting.

TABLE VI

FREQUENCY OF USE OF LETTERS AND PUNCTUATION MARKS IN PRINTER'S FONTS AS COMPARED WITH AVERAGES GIVEN IN TABLE V

	Printer's Font		Av. this Study
E	12,000	1000	1000
T	9,000	750	685
A	8,500	708	684
O	8,000	667	561
S	8,000	667	486
I	8,000	667	484
N	8,000	667	469
R	6,200	517	423
H	6,400	533	402
L	4,000	334	349
D	4,400	367	261
C	3,000	250	231
U	3,400	283	223
M	3,000	250	198
Y	2,000	167	175
B	1,600	133	160
P	1,700	142	158
W	2,000	167	132
F	2,500	208	102
G	1,700	142	99
V	1,200	100	66
K	800	67	41
J	400	33	23
X	400	33	20
Q	500	42	10
Z	200	17	9
	In font of 100 "e"		
.	40	400	86
,	40	400	115
:	5	50	11
;	5	50	16

II. ERRORS IN TYPEWRITING AND THEIR CAUSES

For the purposes of this part of our investigation about 500 full size pages of practice typewriting work were secured, from approximately 100 different individuals, and the errors found therein counted and tabulated up to the point where "E" was charged with 1,000 errors. This point was reached when all but three pages of the material had been checked. The errors for the several letters are given in Table VII,

TABLE VII

ERRORS MADE IN ACTUAL TYPEWRITING AS COMPARED WITH FREQUENCY OF OCCURRENCE OF LETTERS

	Frequency	Errors	Percentage
E	1000	1000	100.
T	685	636	92.8
A	684	596	87.1
O	561	462	82.4
S	486	395	81.3
I	484	378	78.1
N	469	372	79.3
R	423	440	104.
H	402	223	55.5
L	349	339	97.1
D	261	418	160.1
C	231	283	122.5
U	223	224	100.
M	198	321	162.1
Y	175	246	140.6
B	160	97	60.6
P	158	73	46.2
W	132	84	63.6
F	102	209	204.9
G	99	325	328.2
V	66	158	239.4
K	41	96	234.1
J	23	26	113.
X	20	140	700.
Q	10	32	320.
Z	9	20	222.2
Median			108.3

and for convenience of comparison our adopted scale of frequencies of use is given therewith. The percentage rela-

tionship between these two series of data is given in the third column of Table VII, from which it will be seen that twelve letters are as good or better than "E" from the standpoint of accuracy, while thirteen rank below "E." The median is 108.3.

The relationship between accuracy and frequency of use may be definitely calculated by the use of the product-moment formula. The coefficient of correlation is found to be .924

TABLE VIII

COMPARISON OF FREQUENCY OF USE OF LETTERS WITH ACCURACY

	Above Md. in frequency of use +, below —.	Above Md. in number of errors +, below —.	Above Md. in percentage of accuracy +, below —.
E	+	+	+
T	+	+	+
A	+	+	+
O	+	+	+
S	+	+	+
I	+	+	+
N	+	+	+
R	+	+	+
H	+	—	+
L	+	+	+
D	+	+	—
C	+	+	—
U	+	—	+
M	—	+	—
Y	—	—	—
B	—	—	+
P	—	—	+
W	—	—	+
F	—	—	—
G	—	+	—
V	—	—	—
K	—	—	—
J	—	—	—
X	—	—	—
Q	—	—	—
Z	—	—	—

with a P. E. of .021. This shows a very close relationship between use and accuracy and bears out the adage, "Practice makes perfect."

This relationship is set forth in a more graphical way in Table VIII. In the upper half of this table we have the

*The exceptions noted are very near the medians.

thirteen most used letters, in the lower half the thirteen least frequent letters. In the first column the frequency of use of letters is indicated by a plus sign for those letters above the median in use, and a minus sign for those below the median. In the second column a plus sign indicates those letters above the median in number of errors, and a minus sign those below the median in number of errors. There are only two of the thirteen most common letters which are below the median in number of errors, and then by a very narrow margin. Also only two of the thirteen least used letters are above the median in number of errors, nor then by very large margins. In the third column the plus sign indicates those letters which are above the median in percentage of accuracy, while the minus sign indicates those letters which are below the median in accuracy. With five exceptions out of the 26 letters, frequency of use and accuracy go together, or infrequency of use with inaccuracy. One of the five exceptions is by a negligible difference.

We had expected to find that some keys, or rows of keys, on the typewriter would be more accurate than others. The findings contradict this expectation, and indicate that the position of keys on the present keyboard exercises very little if any measurable effect upon accuracy. It has not been found possible to say with any degree of assurance that any one position on the keyboard is better than any other from the standpoint of accuracy.

A further study has been made to ascertain whether the errors made in typing any letter are more likely to occur in combination with certain letters than with others. To answer this question errors were tabulated until 100 had been noted for "E," and in each case the letter after which the error occurred was noted. The results of this study are set forth in Table IX. This table should be read as follows:

TABLE IX

ERRORS AND THE LETTERS AFTER WHICH THEY OCCURRED

E M20, L14, R12, N12, S6, T6, V5, H5, Z5, K3, F3, B3, O2, G2.
T O10, A9, I8, S8, N4, C4, E3, F3, B3, U3, O3.
R E16, O10, A10, M4, H3, P3.
A H10, T10, O4, W4, E3, D3, R2, C2, F2, M2, S1, V1.
S E10, A12, I4, R4, U5, T2, O2, N2, B2.
N N9, A8, O8, R3, U2, I2.
O L8, R6, Y5, D4, T4, G2, H2, O2, E2, W2.
I H6, L5, P4, W2, M2, V2, R2, K2, A2, N2.
D E12, O8, N4, L2, V2, R1.
L U6, P6, E4, F2, O2, A2, I2, G2, R1, B1.
G N11, E4, A4, T2, R1, O1.
H W6, P5, C4, T4, G2, A1.
M O6, I4, U2, E2, L2, R2, S1.
U O6, R4, B3, Y2, D2, G1, H1.
Y A6, N4, B3, T2, F2, R2, N2, H2, C1.
C E8, A4, I2, N2, S2, U1.
V A5, I4, O4, N3, E2, R1.
W A8, S7.
F A3, E2, O2, N1.
B R2, I2, M2, O1, U1.
K O2, R2, I2, N1, A1.
P H3, I2, U1, E1.
X A3, O2, I2, E1.
Q E2.
J A2.
Z D2, A1.

Tabulating from the above the errors made after each of the letters we get the following: After E 81 errors, A 81, O 75, N 46, R 45, I 34, H 32, L 31, M 30, T 30, S 25, U 22, P 18, B 15, W 14, F 12, C 11, D 11, V 10, G 7, Y 7, K 5, Z 5, J 0, Q 0, X 0. Inspection shows that this correlates very highly with the frequency of use of letters, which would indicate merely that most errors happen after the letters most frequently used because most trials occur, and therefore most chance for error after the frequently used letters.

of the 100 errors made in writing "E," 20 occurred after M, 14 after L, 12 after R, 12 after N, 6 after S, 6 after T, 5 after V, 5 after H, 5 after Z, 3 after K, 3 after F, 3 after B, 2 after O, and 2 after G. It does not appear from a study of these data that there is any connection between accuracy and the combination of letters with which any one letter may happen to be written. This serves only to confirm the conclusion that accuracy or inaccuracy is the result of frequent or infrequent practice, due to frequent or infrequent use of the letter.

III. RELATIVE ABILITIES OF THE EIGHT FINGERS AND THE TWO HANDS FOR TYPEWRITING

For the purpose of determining the relative abilities of the eight fingers and the two hands three studies were made. The first of these studies was made upon 50 High School girls; the second on 46 High School boys. In those two studies the following method was used. The subjects were instructed to hold the thumb of the right hand against the center of the typewriter frame, in front of the space bar, and to tap the letter "J" with the first finger of the right hand as rapidly as possible. Thirty seconds were allowed. Then with the thumb of the left hand in the same position, the subject tapped with the first finger of the left hand the letter "F" for thirty seconds. Then in the same way, with the right hand second finger "K," left hand second finger "D," right hand third finger "L," left hand third finger "S," right hand fourth finger ";" left hand fourth finger "A," each for thirty seconds. The number of taps leaving their impressions on typewriter paper in the regular way were counted for each of the eight fingers of each of the 96 subjects.

The purpose of holding the thumb against the metal frame of the typewriter was to eliminate, so far as possible, wrist and arm movements, for it was desired to test only finger abilities. It was found that by holding the thumb in this position the subject was compelled to make the taps by relying upon the fingers alone, as was desired for the purposes of the experiment. The results of these two studies are set forth in Tables X and XI.

TABLE X

TAPPING TEST ON TYPEWRITER—HIGH SCHOOL GIRLS
SHOWING NUMBER OF TAPS MADE BY EACH FINGER IN 30 SECONDS

Number of Subject	LEFT HAND				RIGHT HAND			
	Fingers used				Fingers used			
	4	3	2	1	1	2	3	4
	Letters struck				Letters struck			
	a	s	d	f	j	k	l	;
1	112	117	120	125	131	136	113	153
2	122	134	128	150	117	143	143	143
3	89	108	100	96	96	107	112	108
4	130	129	139	138	129	139	143	129
5	131	124	93	146	112	143	133	117
6	103	135	74	135	122	136	131	106
7	121	141	113	150	138	137	144	113
8	72	63	73	64	60	64	68	69
9	115	128	119	78	151	154	172	140
10	84	92	93	150	98	113	120	94
11	76	90	101	77	88	137	113	100
12	99	128	128	130	119	146	151	135
13	118	122	150	140	106	137	115	100
14	105	130	129	128	137	154	165	152
15	90	106	77	135	123	138	113	102
16	93	95	131	140	140	138	112	101
17	74	74	77	77	76	75	76	76
18	119	140	109	120	151	148	150	159
19	85	126	113	148	155	141	152	91
20	117	120	119	144	154	139	136	134
21	109	116	108	123	113	119	124	121
22	91	117	95	128	103	139	144	121
23	138	131	149	131	139	151	161	153
24	76	117	99	115	101	116	81	80
25	103	110	107	121	89	114	127	98
26	88	102	115	103	108	109	96	90
27	88	103	111	110	107	113	107	114
28	105	143	144	137	147	141	166	156
29	101	117	138	114	122	147	154	152
30	97	117	120	90	116	128	134	119
31	70	92	106	87	107	105	93	75
32	81	101	104	105	101	126	113	103
33	100	119	111	100	109	116	122	99
34	112	122	123	108	141	135	125	146
35	83	122	123	88	117	127	151	128
36	84	94	94	95	84	87	114	110
37	99	130	134	124	129	145	132	154
38	113	132	128	120	135	140	143	149
39	114	104	114	84	81	113	98	106
40	110	125	77	111	126	112	144	118
41	96	104	87	96	99	99	119	112
42	116	130	128	121	150	144	144	145
43	107	131	123	111	112	118	126	127
44	107	108	112	90	140	117	105	134
45	130	128	129	109	121	138	134	147
46	108	118	121	102	119	122	120	127
47	111	127	135	125	121	105	94	92
48	112	109	101	96	100	97	131	134
49	106	109	117	105	120	118	106	100
50	121	110	120	111	125	124	116	110
Averages	103	116	113	115	118	126	126	119
Medians	106	119	117	119	119	130	126	117

TABLE XI

TAPPING TEST ON TYPEWRITER—HIGH SCHOOL BOYS
SHOWING NUMBER OF TAPS MADE BY EACH FINGER IN 30 SECONDS

Number of Subject	Left Hand				Right Hand			
	Fingers used				Fingers used			
	4	3	2	1	1	2	3	4
	Letters struck				Letters struck			
	a	s	d	f	j	k	l	;
1	157	169	134	131	156	187	180	132
2	124	142	160	184	205	217	203	152
3	149	154	124	163	150	180	151	179
4	105	108	117	123	141	149	138	98
5	150	152	152	154	154	151	164	160
6	135	150	163	145	177	180	183	173
7	122	138	145	126	166	161	130	159
8	129	158	163	175	165	153	183	152
9	137	130	193	161	158	167	222	167
10	129	121	151	135	163	166	162	134
11	138	143	138	140	139	152	162	154
12	139	140	141	155	159	146	152	136
13	103	126	125	121	178	201	205	183
14	126	172	155	148	181	182	189	167
15	94	79	96	94	88	139	126	119
16	150	146	153	157	179	181	190	149
17	93	115	136	139	179	176	178	137
18	181	186	186	176	181	204	202	181
19	134	138	158	168	173	206	211	195
20	112	143	126	144	141	148	168	124
21	129	129	143	145	158	164	161	169
22	112	128	131	122	167	195	178	153
23	124	117	124	132	186	130	127	147
24	139	131	141	138	157	157	173	169
25	100	122	139	142	153	168	180	121
26	121	134	151	147	150	163	156	134
27	148	139	142	165	150	169	158	148
28	90	101	120	108	125	141	142	119
29	123	110	128	133	120	143	123	136
30	129	131	127	151	154	174	160	171
31	114	126	142	142	165	187	172	153
32	119	129	143	139	140	173	160	150
33	105	118	155	145	172	196	185	171
34	109	99	115	114	132	132	154	137
35	134	139	169	145	130	169	132	140
36	113	104	122	114	151	140	136	123
37	121	122	139	136	133	165	161	140
38	137	135	149	141	135	178	146	134
39	129	138	144	143	132	143	144	144
40	151	154	157	151	151	168	169	150
41	142	149	169	162	142	140	102	101
42	140	151	168	156	165	188	169	140
43	118	116	125	121	145	156	147	157
44	159	156	176	165	199	212	202	175
45	124	139	141	149	154	146	145	136
46	130	129	145	151	158	155	154	150
Averages	128	134	144	143	156	167	164	148
Medians	127	134	145	145	156	166	164	151

An inspection of the medians in these two tables will show that the eight fingers have about the same rank and relative ability for the two sexes. The only noticeable sex difference is in speed of tapping, with respect to which the boys excelled the girls 24.6 per cent.

The third study was made of 42 college girls and 12 teachers of Frederick County, Maryland. In this study a somewhat different method was pursued. The subjects were required to tap for one minute with a pencil with the right hand, then one minute with the left hand. The marks were subsequently counted to get the scores. (A later study showed that when the subjects attempted to count their taps as they went, their speed was impeded. A few reported that this served to increase their scores.) The subjects were further required to tap for thirty seconds upon their desks with each finger. Particular instructions were given as to the position to be assumed: with the wrist resting upon the desk (to prevent wrist movement in tapping) and with three fingers also resting with their tips upon the desk. It was found that this position effectually prevented any wrist or arm movement being used and secured records of the tapping abilities of the fingers alone.

An inspection of the medians for the eight fingers in Table XII shows that they very closely bear out the results of the first and second studies as shown in Tables X and XI. The three studies above involve a total of 190,410 taps, made by 150 different individuals. It is believed that by combining these three studies by the method of averages, we may secure conclusions as to the relative abilities of the fingers and hands which may be relied upon.

TABLE XII

TAPPING TEST—42 COLLEGE GIRLS, 12 TEACHERS

Number of Subject	Taps per min.		Taps in 30 Seconds							
	Right Hand	Left Hand	R1	L1	R2	L2	R3	L3	R4	L4
1	355	306	185	173	159	129	149	117	179	143
2	360	291	159	138	136	138	118	110	116	105
3	446	367	190	187	161	167	149	145	143	159
4	357	318	140	143	108	138	98	98	106	91
5	443	340	189	173	159	154	118	119	124	119
6	386	350	193	154	132	123	80	99	138	119
7	382	314	183	150	113	115	121	103	150	120
8	368	304	200	173	176	129	120	94	110	97
9	324	175	170	160	150	141	135	106	114	106
10	326	254	168	138	150	105	65	72	83	47
11	390	328	170	149	140	129	135	109	76	114
12	387	312	167	142	140	130	75	120	112	118
13	409	299	140	130	119	117	90	70	99	94
14	397	273	153	144	147	127	85	105	109	90
15	417	307	165	140	136	121	102	101	125	121
16	334	299	199	170	160	137	145	144	140	140
17	398	318	187	136	170	127	123	117	147	132
18	359	314	180	130	101	83	99	92	71	79
19	363	286	155	130	126	110	100	100	120	102
20	342	331	146	152	120	132	116	109	137	122
21	342	329	179	165	142	139	95	98	138	140
22	400	378	171	190	156	150	114	130	141	149
23	352	330	151	146	138	125	92	80	115	101
24	326	372	130	120	130	160	100	120	112	120
25	343	271	152	143	126	113	106	90	130	112
26	294	289	126	110	126	111	104	103	118	115
27	383	309	193	160	190	123	97	107	147	109
28	367	282	150	140	149	123	95	103	111	109
29	355	265	136	118	96	94	60	65	74	71
30	322	285	142	123	109	83	100	83	123	93
31	253	291	150	121	149	130	111	80	109	103
32	374	314	101	94	115	100	78	60	110	103
33	407	310	201	165	157	149	145	141	162	147
34	309	226	143	110	103	64	67	78	100	92
35	415	334	201	171	190	167	173	151	179	147
36	354	303	160	136	140	100	87	90	102	106
37	363	326	155	160	132	132	110	108	108	102
38	340	346	160	150	120	120	109	100	118	113
39	434	344	170	170	148	130	106	111	125	110
40	392	288	172	136	132	140	130	123	139	128
41	317	205	157	120	139	122	90	100	122	95
42	281	280	125	98	90	82	65	50	90	75
43	290	292	150	143	146	103	60	62	63	78
44	402	360	135	121	102	101	40	80	81	86
45	332	340	199	215	146	160	82	130	77	102
46	370	300	150	140	55	53	75	60	65	60
47	360	280	199	142	98	82	105	100	110	92
48	400	380	102	114	117	128	40	33	103	114
49	404	342	184	161	167	149	92	104	110	103
50	408	392	155	159	150	122	102	100	119	90
51	374	314	150	118	135	102	108	94	116	89
52	314	374	149	141	164	155	130	140	150	120
53	408	298	123	94	93	76	15	61	70	68
54	472	324	140	115	98	78	59	60	65	62
Averages	363	310	161	143	134	121	101	99	115	106
Medians	365	311	160	145	138	125	104	103	117	107

NOTE.—R1 is used as an abbreviation for "the first finger of the right hand." In the same way the other symbols are to be interpreted.

IV. THE FINGER AND HAND LOADS OF THE PRESENT TYPEWRITER KEYBOARD

Since the foregoing studies make it possible to state in a mathematical form the relative abilities of the two hands and the eight fingers, and the relative values of each letter and mark, it would seem worth while first to raise the question, what is being expected of the fingers and hands by the present typewriter keyboard. We are assuming, of course, that

TABLE XIII

THE TYPEWRITING LOAD OF THE EIGHT FINGERS AND THE RIGHT AND LEFT HANDS

RIGHT HAND				
Fingers	1	2	3	4
	y 175	i 484	o 561	p 158
	h 402	k 41	l 349	; 16
	n 469	. 115	. 86	: 11
	u 223			? 11
	j 23			Shift 100
	m 198			
	1490	640	996	296

Total for the right hand: 3422

LEFT HAND				
Fingers	1	2	3	4
	r 423	e 1000	w 152	q 10
	f 102	d 261	s 486	a 684
	v 66	c 231	x 20	z 9
	t 685			Shift 100
	g 99			
	b 160			
	1535	1492	658	803

Total for the left hand: 4488

the typewriter is to be used by a touch operator. Probably very few persons are any longer disposed to dispute the great advantage of the "touch" method for speed and accuracy. Its advantage from the standpoint of fatigue is still greater.

In accordance with the touch method each of the eight fingers has its own proper keys, three for each finger except the first finger of each hand which has six. Table XIII gives for each finger the letters it strikes and their values, and the sum of these, which is the finger load. These letter values are taken from Table V. Denoting the fingers of the right hand as R1, R2, R3 and R4, and those of the left hand as L1, L2, L3 and L4, we find their loads to be, in the same order: R1, 1,490; R2, 640; R3, 996; R4, 296; L1, 1,535; L2, 1,492; L3, 658; L4, 803. Adding these finger loads for each hand we get the hand loads: for the right hand 3,422, for the left 4,488. In view of the fact that in Tables X, XI and XII we found finger abilities to be not very dissimilar, it is rather startling to find that R1, L1, and L2 are each, on the present typewriter keyboard, given more than five times as much work to do as is given to R4. In view, also, of the generally known fact that the index of right-handedness may be roughly expressed by the ratio of ten to nine, that is, that the ability of the right hand is approximately one-ninth greater than that of the left, it is surprising to find that the present keyboard gives a far heavier load to the weaker member.

The question may be raised: Why are 100 strikes recorded for both the right and left hand Shift Key? This was gotten by actual count, 200 being recorded. However, whether the right hand strikes exactly half of them or not will vary somewhat with the nature of the matter to be written. When a letter on the left side of the present keyboard is capitalized the right shift key must be struck and vice versa. Inasmuch as most of the letters are on the left side of the keyboard and many of them the more frequent in use, it is very probable that the right shift key is the more frequently used. However, the total number will remain the same and an equal division of the total 200, while not entirely exact, is as near as can be gotten.

V. THE CONSIDERATIONS TO BE TAKEN INTO ACCOUNT IN THE ARRANGEMENT OF AN IDEAL KEYBOARD BASED ON SCIENTIFIC PRINCIPLES, AND A SUGGESTION FOR SUCH KEYBOARD

The several considerations which should control a scientific rearrangement of the typewriter keyboard are the following:

1. The measured abilities of the eight fingers and of the right as compared with the left hand, should be taken into consideration, and loads assigned in proportion to strength.

2. The measured frequency of use of the letters of the alphabet and punctuation marks must be made the basis for calculating the loads to be assigned to the several fingers.

3. In addition to the above there are certain pedagogical considerations:

(a) The most used letters should be assigned to the "home" or guide keys, since on a keyboard so arranged the work could be done with the fewest possible changes of position of hands. Also the frequent use of these letters will aid the pupil in the early fixing of these home-key positions.

(b) The next most used letters should be assigned to those keys or positions which appear to be the favorable ones from the standpoint of accuracy.

(c) Since beginners find it easier to use the first fingers than the other fingers, and since the approved method of teaching typewriting, as well as other subjects, is that of proceeding from the easy to the more difficult, it is desirable so to arrange the keyboard, by assigning several of the vowels to the first fingers, that simple practice words and sentences may be written by the beginner, even in the earliest stages of the learning process.

For purposes of the first consideration, Table XIV assembles the data from Tables X, XI and XII, i. e., the median tapping abilities of the eight fingers of high school

TABLE XIV

COMPARISON OF FINGER AND HAND ABILITIES WITH THE LOADS OF THE FINGERS AND HANDS

	Left Hand				Right Hand				
	4	3	2	1	1	2	3	4	Total
Mds. for H. S. Girls..	106	119	117	119	119	130	126	117	
Mds. for H. S. Boys..	127	134	145	145	156	166	164	151	
Mds. College Girls and Teachers	107	103	125	145	160	138	104	117	
Averages	113	119	129	136	145	145	131	128	=1046
Multiplying these ave. by 7.56 to get ideal typewriting loads:....	855	900	975	1028	1097	1096	991	968	
The loads on the present keyboard are....	803	658	1492	1535	1490	640	996	296	
Percentage of over- or under-load of the fingers on present typewriter keyboard.....	—6.1	—26.9	+53.	+49.3	+35.8	—41.6	+.5	—69.4	

	Left Hand		Right Hand
Tapping ability (190,410 taps by 150 individuals)	89,593 taps		100,817 taps
	Ratio: 88.87	to	100
Present load.....	4,488 taps		3,422 taps
	Ratio: 131.25	to	100
Per cent of over- or under-load.....	47.7 (over-load of left hand as compared with right.)		

girls, high school boys, and college girls and teachers, combining the three by the method of averages and showing a total of finger abilities of 1,046. Table XIV also includes the present keyboard load from Table XIII. Dividing the total keyboard load (7,910—the sum of 3,422 and 4,488 of Table XIII) by the sum of the finger abilities (1,046, Table XIV) we find that each point of finger ability must be multiplied by 7.56 so as to reapportion the whole load upon the fingers in proportion to their abilities. Comparing the ideal finger loads with the present finger loads, we find four overloads of 49.3, 53., 35.8, and .5; also four under-loads, 5.1, 26.9, 41.6, and 69.4.

Of the 190,410 taps made in this study, 100,817 were made by the right hand, and 89,593 by the left, in equal time. Therefore the ratio of the ability of the right hand to that of the left is as 100 to 88.87, or approximately as ten is to nine. This agrees with the findings of Bryan.* The present

*BRYAN, American Journal of Psychology, 1892, V, 123-204.

right and left hand loads in typewriting are 3,422 taps for the right to 4,488 for the left, or a ratio of 100 to 131.25. These data show an overload of the left hand of 47.7 per cent as compared with the right hand, on the present typewriter keyboard. The over-loads and under-loads discovered are more graphically shown in Figure 2.

The criticism might perhaps be advanced that in combining the measures of the tapping abilities of the several fingers as obtained on the typewriter, with those obtained in tapping on desks, two different, and for all we know, heterogeneous sets of data are being added together. In reply to this suggestion the following considerations are advanced and need to be taken into account.

First, it should be borne in mind that the same purpose was uppermost in these two sorts of experimentation, namely, the attempt to get a mathematical statement of the comparative abilities of the several fingers. The two experiments are alike in that both attempt to secure an accurate count of the number of taps each finger can make in the same period of thirty seconds, or of one minute.

Second, it is true that tapping on a desk is not, so far as we know, the same thing as tapping the keys of a typewriter in the ordinary use of that machine. But it is also true that tapping the keys of a typewriter under the controlled situation, namely, with the thumb touching the frame of the machine, beneath the space bar, may, for all we know, be no more like the process of actual typewriting than is tapping on a desk as described above. In fact, it may be that the former more nearly approximates the actual process involved in typewriting than does the latter. Both are controlled situations, with the purpose of preventing an undue influence upon the outcome as a result of leaving the arm and wrist free to do the tapping, instead of compelling the fingers to do it.

Third, of the three sets of data which are combined in Table XIV, the third (the results of tapping on desks) does not differ more from either the first (the results for high

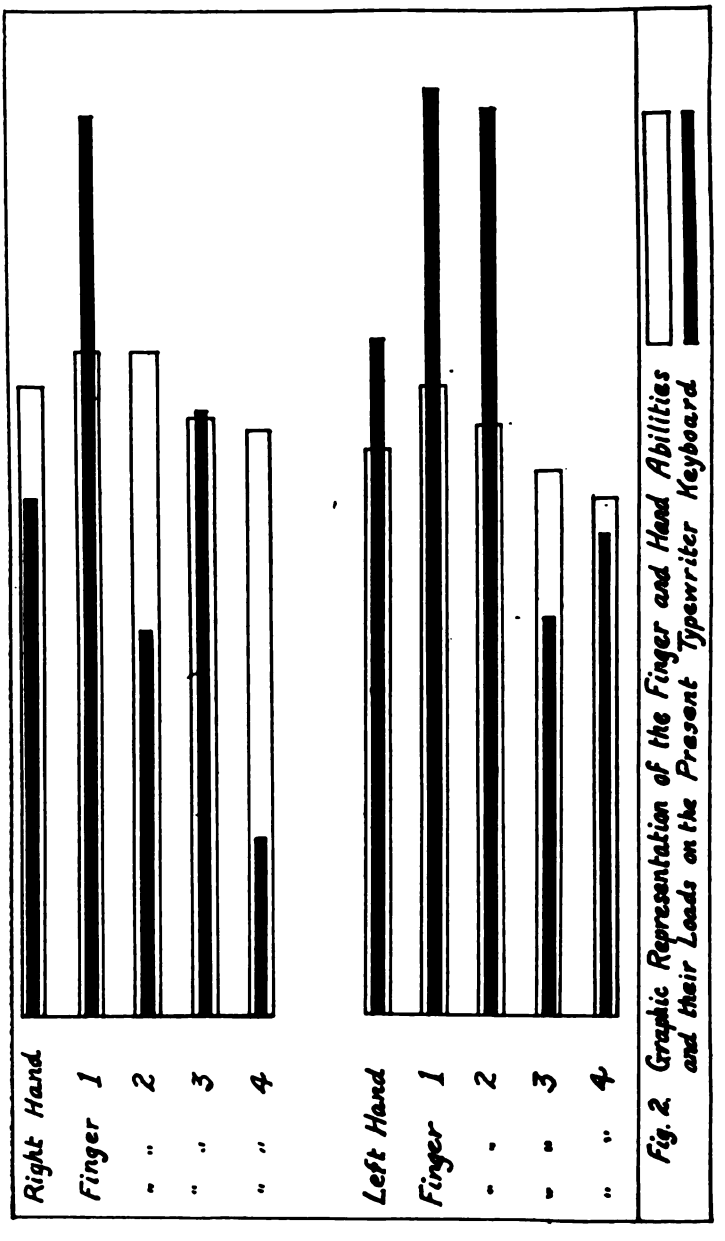

Fig. 2. Graphic Representation of the Finger and Hand Abilities and their Leads on the Present Typewriter Keyboard

school girls tapping on typewriters) or the second (the results for high school boys tapping on typewriters) than the first differs from the second. Therefore, an argument against including the third, because it differs from the first and second, would be just as good an argument, so far as it goes, for excluding either the first or second because it differs from the other.

Fourth, the average scores for the fingers secured by combining the three sets of data in Table XIV differ from the scores which would have been secured by combining only the two first sets of data of that table by only a little over four per cent. So far as the relative abilities of the two

TABLE XV

COMPARISON OF FINGER-LOADS OF STANDARD AND PROPOSED KEYBOARDS WITH IDEAL LOADS

	LEFT HAND				RIGHT HAND			
	Fingers				*Fingers*			
	4	3	2	1	1	2	3	4
	Y	D	M	C W	Q F	V	L	P
	R	N	T	H U	S I	E	O	A
	B	P	G	J X	Z ? /	: ;	. .	, ,
Load on above keyboard	858	888	982	1031	1098	1093	996	971
Ideal load ...	855	900	975	1028	1097	1097	991	968
Load on present keyboard	803	658	1492	1535	1490	640	996	296

hands are concerned, the three sets of data agree, all giving the ratio of approximately ten to nine. This larger result is therefore unaffected by the inclusion or exclusion of the third set of data. A study of the suggested keyboard (Table XV) will reveal the fact that it was found impossible so to assign loads as to give each finger *exactly* the proper amount of work. In the case of the third finger of the left hand the error amounts to as much as one and one-third per cent. In view of this fact the above mentioned difference of four per cent loses much of its significance.

Fifth, the fact is generally known, especially among pianists and typists, that the third finger is the least capable. This fact is not so clearly revealed in the first two sets of data of Table XIV as in the third. This may perhaps be explained by saying that the third finger, in the case of the experiment on the typewriter, being further removed from the fixed point, the thumb, than was the first or second finger, was perhaps aided somewhat in its tapping by the movement

TABLE XVI

THE ACCURACY OF HORIZONTAL LINES OF KEYS ON TYPEWRITER

Upper Line			Middle Line			Lower Line		
	Rank in use	% of errors		Rank in use	% of errors		Rank in use	% of errors
Q	25	320	A	3	87	Z	26	222
W	18	64	S	5	81	X	24	700
E	1	100	D	11	160	C	12	123
R	8	104	F	19	205	V	21	239
T	2	93	G	20	328	B	16	61
Y	15	141	H	9	56	N	7	79
U	13	100	J	23	113	M	14	162
I	6	78	K	22	234			
O	4	82	L	10	97			
P	17	46						
Averages..	10.9	112.8		13.6	151.2		17.1	226.7

COMPARISON OF THE RANK OF THE EIGHT FINGERS AND THE HANDS IN ACCURACY AND IN LOAD IN TYPEWRITING

	Fingers	Rank in Accuracy	Rank in Load
Right hand	1	3	6
	2	5	2
	3	2	5
	4	1	1
Left hand	1	6	8
	2	4	7
	3	8	3
	4	7	4
Right hand	108% of errors		3422
Left hand	192% of errors		4488

of the wrist and arm. Should this explanation be the correct one, it would appear that the third experiment avoided this chance for error, and is to that extent a corrective. It is the opinion of the writer that the inclusion of the third set of

data in the averages gives a truer estimate of the abilities of the fingers than would be the case were these data omitted.

To return to the considerations which must be taken into account in arranging a keyboard along scientific lines, it was noted as one of the pedagogical considerations that the eight most frequently used letters should be assigned to the home keys, so far as this may be found to be possible without overloading of fingers. Also, that several of the vowels should be assigned to the first fingers, for the reason stated.

TABLE XVII

THE ACCURACY OF THE EIGHT FINGERS IN TYPEWRITING (PERCENTAGES)

RIGHT HAND

Fingers	1	2	3	4
	y 141	i 78	o 82	p 46
	h 56	k 234	l 97	
	n 79	,	.	
	u 100			
	j 113			
	m 162			
Averages..	108	156	89	46

Average for the right hand: 108

LEFT HAND

Fingers	1	2	3	4
	r 104	e 100	w 64	q 320
	f 205	d 160	s 81	a 87
	v 239	c 123	x 700	z 222
	t 93			
	g 328			
	b 61			
Averages..	172	128	282	210

Average for the left hand: 192

From the consideration of accuracy two results might follow. It might be found that for certain vertical rows of keys, or the fingers assigned thereto, there was greater accuracy, or that for certain horizontal rows there was more accuracy than for others. These two possibilities are studied in Table XVI. In the upper half of this table accuracy is compared with frequency of use for each of the horizontal rows

of keys. In Table VIII we show that, with reference to the individual letters, accuracy and frequency of use are almost perfectly correlated. Table XVI, however, seems to show that we have the greatest accuracy in the upper horizontal line, with decreasing accuracy in the middle and especially in the lower lines, *to an extent that is not justified by use or disuse.* Since this is the case, it will be well to assign the more frequently used letters, after the home keys have been supplied, to the upper row of keys.

The second part of Table XVI, on the other hand, shows differences in accuracy of fingers, that is, of vertical rows of keys. The accuracy data are taken from Table XVII. But while the accuracy of fingers seems to differ, it appears from the table that this is due to the loads assigned to the fingers and hands, rather than to qualities of the fingers or hands themselves. For when the fingers are given their rank for accuracy and for load, we find a close correlation. The overloaded fingers tend to be inaccurate. In the case of the two hands the evidence is even more clear. The right hand with the smaller load has the better accuracy score. The average frequency of use of letters written by the left hand on the present keyboard is 291, by the right 280. So far as the law of use goes, the left hand should be four per cent more accurate than the right. Instead of this we find the right hand 84% more accurate than the left. This must be due to the over-load of the left hand.

This evidence tends to show that nearly half of the errors made by the left hand in typewriting are preventable, since they are due to the bad apportioning of the typewriting load on the present keyboard.

A further important reason why the typewriter keyboard should be scientifically rearranged is the self-evident fact that maximum speed and ease of operation can never be attained so long as some fingers are over-worked, while others do not have a chance to contribute their full share to the total result.

A rearrangement of the keyboard will, it is clear, make for improved speed and accuracy in typewriting.

The present standard arrangement of the typewriter keyboard antedates the "touch" method of operating, which has come to be the only accepted method in the teaching of typewriting. Therefore the considerations, if any, which suggested the present arrangement of the keyboard, do not apply, but new considerations must be brought to bear which take account of the fact that *all* of the fingers are to be used and should contribute their share, no more and no less.

In accordance with the above considerations we offer the preferred rearrangement of the letters and marks of the typewriter keyboard shown in Figure 3.

In addition to the improvements in the arrangement of the typewriter keyboard based on the investigations and considerations hereinbefore set forth, Figure 3 shows certain other changes from the conventional arrangement which remain to be explained. These changes are (1) the interposing between the right and left banks of keys of the shift lock, shift, and back spacer keys, and (2) the placing of the margin and tabular keys in the lower horizontal row of keys, one at either end.

In general, it may be said, first of all, that both these changes are made in an effort to make the keyboard arrangement more compact, thereby bringing all keys within reach of the fingers without unnecessary hand movements. These keys are, for the most part, usually so placed on the typewriter as to require the operator to remove the fingers from the letter keys. Furthermore, the shift key, shift lock, and back spacer are the heaviest keys on the typewriter. The back spacer operates against the tension of the machine and is probably the heaviest key of all. The shift key and shift lock usually lift either the carriage or the basket of keys. In either case, the operation of these keys requires far more force than the operation of the letter keys. It is felt, therefore, that these three keys should be placed in a central position, as in Figure 3, so that they may be operated by the

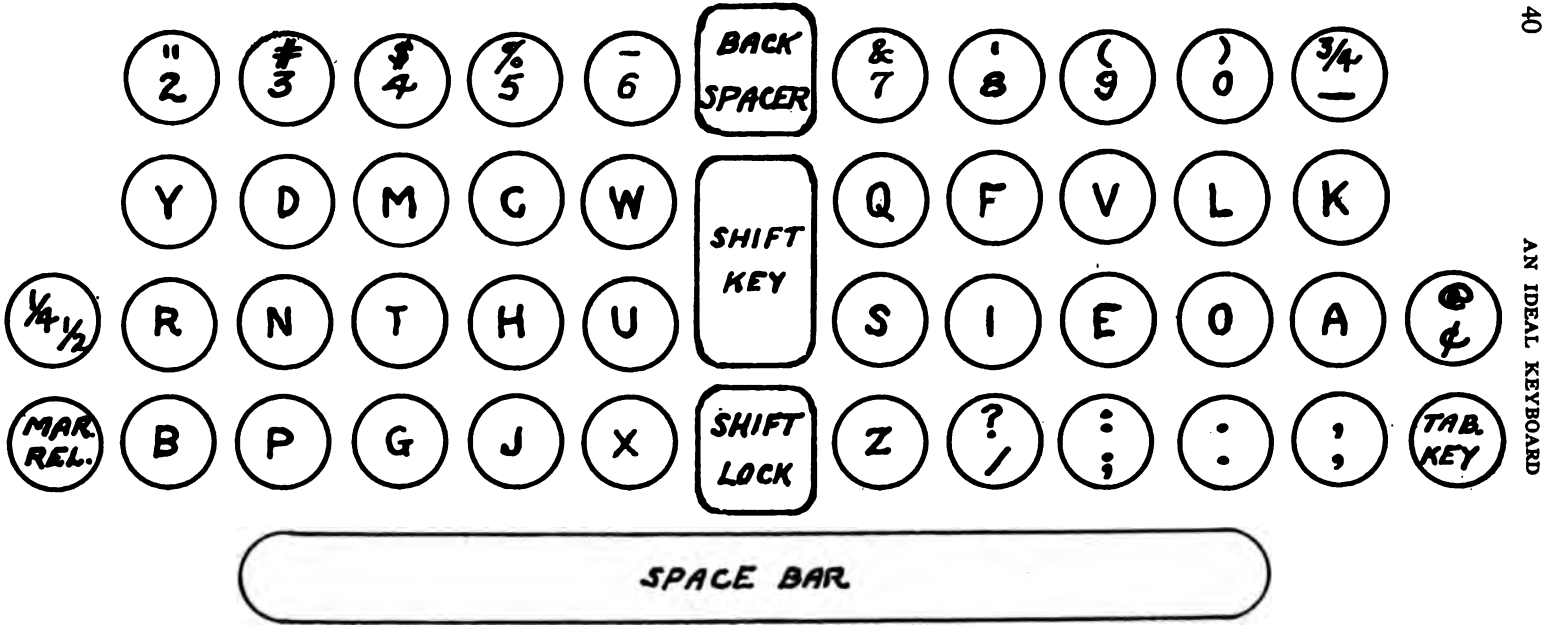

Fig. 3. Suggested Rearrangement of Typewriter Keyboard.

thumb or first finger, rather than by the fourth finger, whose strength is scarcely adequate. The margin release and tabular key are very light in touch, and not often used, so that in assigning them to the fourth fingers, as in Fig. 3, we are not unduly burdening these weak fingers.

The advantages of this arrangement are: 1. The keys in question are brought into a convenient position for operation by the thumb or first finger of either hand. 2. The entire keyboard can be operated without removing the hands from the position they take when the fingers are placed upon the "home keys," as the keys of the middle horizontal row of letters are called in touch typewriting. 3. The interposition of the shift, shift-lock and back spacer keys divides the keyboard into right and left halves, thereby tending to avoid errors and undesirable hand movement resulting from the encroachment of one hand on the territory of the other. 4. The interposed keys accentuate the importance and make necessary the confining of each hand to its appropriate bank of keys, with a minimum of movement for complete performance of the entire duty assigned it. These four advantages, together with all the other advantages claimed for the keyboard as shown in Figure 3, may be summed up, in a general way, by saying that *this keyboard is definitely planned for the most accurate and economical operation by the touch method,* the method which is now being taught in practically all schools, whereas the present conventional, so-called standard and universal keyboards have been arranged with reference to no discoverable or known criteria whatsoever.

BIBLIOGRAPHY

AYRES, LEONARD P. (1915.) Measuring Scale for Ability in Spelling. Russell Sage Foundation, New York.

——— (1912). The Spelling Vocabularies of Personal and Business Letters. Russell Sage Foundation, New York.

BOOK, W. F. (1908). The Psychology of Skill: With Special Reference to Its Acquisition in Typewriting. University of Montana Publications in Psychology; Bulletin No. 53. Psychological Series No. 1.

BRYAN, W. L. (1892). On the Development of Voluntary Motor Ability. American Journal of Psychology, Vol. 5, pp. 123ff.

BRYAN AND HARTER. Studies in Telegraphic Language. Psychological Review, Vol. 6.

BURK, F. (1898). From Fundamental to Accessory in the Development of the Nervous System and of Movements. Pedagogical Seminary, Vol. 6, pp. 5-64.

COOK AND O'SHEA (1914). The Child and His Spelling. Indianapolis, Ind.

ELDRIDGE (1911). Six Thousand Common English Words. Niagara Falls, N. Y.

FRITZ AND ELDRIDGE. Expert Typewriting. American Book Company, New York.

GORDON, KATE (1917). Educational Psychology. Henry Holt and Company, New York.

GOULD, G. M. (1908). Right-handedness and Left-handedness. J. B. Lippincott Company, Philadelphia.

JUDD, C. H. (1915). The Psychology of the High School Subjects. Ginn and Company, New York.

KNOWLES, REV. J. (1904). The London Point System of Reading for the Blind. London, England.

OWEN, MARGARET B. (1917). The Secret of Typewriting Speed. Forbes and Company, Chicago.

PARKER, S. C. (1915). Methods of Teaching in High Schools. Ginn and Company, New York.

ROSS, J. W. (1921). Typewriting Manual. Rowe Publishing Company, Baltimore, Md.

SORELLE, RUPERT P. and CUTLER, IDA MCL. Rational Typewriting. The Gregg Publishing Company, New York.

SORELLE, RUPERT P. Methods of Teaching Typewriting. The Gregg Publishing Company, New York.

STARCH, D. Periods of Work in Learning. Journal of Educational Psychology, Vol. 3, pp. 209-213.

THORNDIKE, E. L. Practice in the Case of Typewriting. Pedagogical Seminary, Vol. 20. pp. 516-529.

——— (1914). Educational Psychology: Briefer Course. Teachers College, Columbia University.

WILSON, D. (1891). The Right Hand: Left-handedness. The Macmillan Company, New York.

WASHBURN, M. F. (1916). Movement and Mental Imagery. Houghton Mifflin Company, New York.

WOODWORTH, R. S. (1903). Le Mouvement. Paris.

——— Accuracy of Voluntary Movement. Psychological Review, Monograph 3.

WOOLLEY, H. B. The Development of Right-handedness in a Normal Infant. Psychological Review, 17. 1910, pp. 37-41.

THE PERMANENCE OF THE VOCATIONAL INTERESTS OF JUNIOR HIGH SCHOOL PUPILS

THE JOHNS HOPKINS UNIVERSITY
STUDIES IN EDUCATION

No. 8

EDITED BY
EDWARD F. BUCHNER

THE PERMANENCE OF THE VOCATIONAL INTERESTS OF JUNIOR HIGH SCHOOL PUPILS

BY
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E. E. F.

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CHAPTER I

The Place of Interest in Education

The modern concept of interest arose in the eighteenth century and found its first proponent in the person of Jean Jacques Rousseau. However, since no new concept is free from indebtedness to the past, it may be of value to sketch briefly the development of earlier cognate ideas. The earliest of these is the contribution of Aristotle. In his effort to solve the problem arising from the contest between individual interests and social welfare, he set up happiness as the goal of life. Explaining happiness as the result of goodness, he showed that the latter is twofold in its nature, consisting of well-being and well-doing. By well-being, he refers to individual development and welfare. For instance, he advocates the inclusion of music in the curriculum because it is an amusement. The recognition of individual differences was more explicit among the Romans than among the Greeks. Quintilian objects to the disciplinary use of physical force and insists that the studies should be made attractive. The following quotations from his "Institutes of Oratory" will serve to make his position clear: "Let his (the pupil's) instruction be an amusement to him."[1] "Let him that is skilled in teaching ascertain first of all, when a boy is entrusted to him, his ability and disposition."[2] Elsewhere Quintilian claims that character should be the end of education and emphasizes the fact that the teacher should respect the individuality of the child.

The next educator, whose ideas and practices are of interest from our present viewpoint, is Vittorino da Feltre (1378-1446). He aimed to make the life of his pupils as attractive and as full of activity as possible. Monroe admirably sums up his practices in the following words: "Self-government

[1] Watson, 1891, vol. I, p. 14.
[2] Watson, 1891, vol. I, p. 25.

by the boys of the school, a dependence upon the natural interests of the pupil, use of the natural activities of the child as a basis for much of the work, and a strong emphasis upon activities and upon the constructive side of the work as furnishing an immediate introduction into a useful life, were some of the features exemplified in this school at Mantua."[1]

A century after Vittorino, another educator, Rabelais (1483-1553) advocated similar ideas. He urged that school studies be made pleasant and suggested that games and sports be included in the school activities. On the whole, his proposals are largely a repetition of those made by Quintilian and Vittorino.

The pre-Rousselian ideas of interest are essentially different from the modern concept. They imply the attachment of pleasantness to the work by the application of external means. They seek to amuse the child, to assure him of a pleasant time in school. This is very different from our present dynamic conception of interest wherein it means identification of the learner with the material to be learned. In modern school procedure, interest is the motivating power that drives to accomplishment.

Rousseau (1712-1778) broke away sharply from his predecessors. He proposed that the interest and curiosity of the child should be used as the motive for study. Rousseau would have the whole education of the individual based upon his own natural interests and determined by his inherent capacities and tendencies. To him the value of any educating lay in the interest aroused in the child. True education, being development from within, can be attained only through the working out of natural interests and instincts. Hence, Rousseau was a vigorous opponent of the application of external force as a means of educating. His ideas initiated the conflict between the "education of interest" and "the education of effort" that has not yet been settled to everyone's satisfaction. Basedow (1723-1790) introduced Rousseau's doctrines into Germany. His goal was "education according to

[1] Monroe, 1908, p. 377.

nature" and he sought to intrigue the interests of the children both by the content of his curriculum and by his methods of teaching.

Pestalozzi (1746-1827) took over many of the ideas of Rousseau and Basedow and worked them out more fully. He considered education as the continuous development of the mind and this development as dependent upon suitable exercises being provided. He pointed out that the child develops mentally only through his own activities and that these activities are most important when they are the outcome of the child's spontaneous desires. It is such activities that lead to growth and the direction of growth is determined by the original nature of the particular child.

The importance of interest as the motivating power of education had increased rapidly in pedagogical circles from the days of Rousseau onward. In the case of Herbart (1776-1841) it became the cornerstone of the educational edifice that he attempted to rear. He based his work upon that of Pestalozzi, extensively developing it and adding many contributions of his own. With Herbart, a definite doctrine of interest first appears. Thus, while the germs of the doctrine are found scattered through the centuries, the doctrine itself first finds forceful and adequate expression in the nineteenth century. Herbart claimed that the ultimate end of education was virtue, but that this final aim could be realized only through setting a nearer and more practical goal. This latter one he called many-sidedness of interest; around it his chief contributions center. He says: "The word interest indicates in general the sort of intellectual activity which instruction should cause, since it cannot arise from mere knowledge. For one regards mere knowledge as a store which might indeed be lacking without a man being in any way different on that account. On the other hand, he who has a firm grasp of his knowledge, and seeks to extend it, is interested in it. Since, however, this mental activity is varied, we need to add the further determination supplied by the term "many-sided."[1]

[1] Monroe, 1908, p. 633.

In the "Science of Education" he says: "In one word, the aim of education is subdivided according to the aims of choice —not of the teacher, nor of the boy, but of the future man, and the aims of morality."[1] "How can the teacher assume for himself beforehand the merely *possible* future aims of the pupil?" "Every man must have a love for all activities, each must be a virtuoso in one. But the virtuoship is a matter of choice; on the contrary, the manifold receptivity which can only grow out of manifold beginnings of one's own individual efforts, is a matter of education."[2] To bring about this manifold receptivity he proposes the development of many-sidedness of interest—proportionate many-sidedness. This will tend to make the individual sympathetic toward the interests and activities of others, and give him a starting-point from which to develop his own main life interest. Herbart says that knowledge and sympathy are the two primary divisions of interest. His classification of interests follows:

INTEREST

IN KNOWLEDGE	IN SYMPATHY
1. Empirical interest.	1. Sympathetic interest.
2. Speculative interest.	2. Social interest.
3. Aesthetic interest.	3. Religious interest.

The attainment of the perfect many-sided culture of the mind depends upon these six kinds of interest having been placed in balanced action.

Herbart links interest and apperception closely. In fact, he defines interest as the mental activity or condition that accompanies apperception. The principle of apperception leads us straight to child study. The teacher is obliged to inform himself of the child's previous knowledge and interests in order that he may use them as the basis of further instruction and learning.

The remarkable development of the doctrine of interest during the nineteenth century cannot be fully appreciated unless we give some consideration to the contributions of

[1] Herbart, p. 109.
[2] Herbart, pp. 110-111.

Froebel (1782-1852). He maintained that real education must take its roots in the spontaneous activity of the child and must eventuate in enduring volitional interests. He held, as worthy subject-matter of instruction, only that material which comes from life, and from life only in so far as it enters the experience of the child. Thus, Froebel's plan of education is definitely based upon a utilization of the child's interests and capacities.

The recognition of interest as a determinant in educational practices did not occur in America until toward the middle of the nineteenth century. This recognition first appeared in the sphere of higher education. As early as 1825 the University of Virginia had been established with the avowed policy of permitting complete freedom of choice on the part of the students. Such freedom began to wedge its way gradually into Harvard from 1845 on. Upon his inauguration as president of that institution in 1869, Dr. Charles W. Eliot granted the students complete freedom in the election of subjects. Cornell University had been established upon the basis of complete freedom two years earlier. These striking and pioneer efforts were soon imitated by other American institutions of higher education.

After Herbart's death, his doctrines were extended, worked over, and crystallized by his followers in Germany and had a pronounced effect upon educational content and method in that country. At about 1890 the movement was transported to the United States where it flourished vigorously for a while and brought about thorough-going and lasting changes in educational practice. Frank McMurry, Charles McMurry, and Charles De Garmo were the leaders of the American Herbartian movement. In 1902, De Garmo wrote a book entitled "Interest and Education" in which he endeavors to make a concrete application of the doctrine of interest to practical, class-room education. A few of his arguments may be stated in brief here. He says: "May it not be that to establish desirable permanent mental attitudes toward men and their institutions and toward nature and her living creatures is one of the choicest opportunities, not to say most

imperative duties of the school?"[1] "We may say in general that interest is a feeling that accompanies the idea of self-expression. . . . Interest is therefore dynamic in character."[2] He distinguishes between clear and vivid ideas, indicating that while the former tend to produce only inner illumination, the latter tend ever to pass into action and are the source of genuine interest. What is an object of interest to one person, may have no effect whatever upon another. Hence, elective studies must be provided if the varied interests of the individual pupils are to be appealed to. Urban conditions necessitate abundant motor activities if the worth-while interests of the child are to be met. De Garmo urges that methods of instruction should be based upon the interests and potential interests of the pupils. He advocates concreteness in instruction in order that there may be fertile ground for the development of vivid ideas. Above all, he proposes a utilization of interest as a means of securing real thinking on the part of the pupil. This proposal refers to the problem method, which serves as a natural transition to the contributions of John Dewey.

Dewey has contributed more than anyone else to the harmonization of interest and effort. He organized an experimental elementary school at the University of Chicago in 1896 and conducted it for seven years. The core of his educational theory is, to a large extent, the experience he gained there while applying the psychological principles that he had worked out. The basis of all his theorizing is that "the school cannot be a preparation for life except as it reproduces the typical conditions of social life." Perhaps his most important contribution to education has been the "problem method" of teaching and learning. He has shown that induction and deduction do not include the entire intellectual process. In the words of Duggan, "Professor Dewey has pointed out that these are the thought-processes only of one who has already through experience mastered the subject-matter of his field,

[1] 1908, p. VIII.
[2] 1908, pp. 18-19.

and that by far the greater part of our intellectual process is antecedent to this stage. We must, therefore, study these antecedent processes by which the mind of the individual comes into relation with the objective world, and find in them the methods for the greater part of our teaching. Professor Dewey finds the characteristic feature of them to be 'interest,' by which he means a more or less conscious and partly instinctive desire of the individual to attain some end. But interest is to be considered only a stimulus to the higher intellectual processes, into harmony with whose workings the teacher must bring his schoolwork."[1] In his book entitled "Interest and Effort," Dewey makes a successful attempt to harmonize the "education of interest" with the "education of effort." He proves that neither theory is satisfactory, but that both contain parts of a larger truth that will function. "The genuine principle of interest is the principle of the recognized identity of the fact to be learned or the action proposed with the growing self; that it lies in the direction of the agent's own growth, and is, therefore, imperiously demanded, if the agent is to be himself. Let this condition of identification once be secured, and we have neither to appeal to sheer strength of will, nor to occupy ourselves with making things interesting."[2] This quotation gives his proposed remedy. When a suitable problem (that is, one that meets his present needs) is set before the child, it enlists his interests and effort naturally arises in his attempt to satisfy these interests. In Dewey's words, "Interest means a unified activity."[3] Interest is of value only when it brings about growth, or development. There are times when interest in some distant end works its way back into the means which would otherwise be either colorless, or even distasteful in themselves. Dewey notes four types of educative interest: (1) physical activity; (2) constructive activity; (3) intellectual activity; and (4) social activity. To Dewey, interest is fundamentally identification

[1] Duggan, 1916, pp. 321-322.
[2] Dewey, 1913, p. 7.
[3] Dewey, 1913, p. 15.

of the learner with the matter to be learned. In "Democracy and Education" he writes: "In fact, self and interest are two names for the same fact; the kind and amount of interest actively taken in a thing reveals and measures the quality of selfhood which exists."[1]

Modern psychologists have given much attention to interest. Only a few whose contributions have been most significant may be considered here. William James considered interest as probably the most important element in the determination of a man's mental efficiency. He showed how through proper association interest may be created in new objects of thought. He explained how, growing out of each other, the interests of the child are gradually built up until, when he becomes an adult, most of his interests are exceedingly artificial. The importance of the investigations of G. Stanley Hall and his followers in arousing interest in child-study cannot be overestimated. A number of their studies deal with the interests of children. These investigators concluded that different interests develop at different times and they endeavored to locate the natural periods for the outcropping of the more important groups of interests. Such investigations led to important changes in educational procedure and administration in this country. The most significant of these changes has been the inception and development of the junior high school. Study of the interests and capacities of the children of early adolescence led to the belief that children should have, during that period, a type of education suited to their own peculiar needs and, therefore, different from that provided in the elementary school and likewise from that offered in the secondary school. Educators began to realize that this must be largely an exploratory period. The pupils' individual interests must be respected and the opportunity to choose must be provided earlier than in the high school. The junior high school is thus an objective recognition of children's interests and a serious effort to adjust education to those interests.

[1] Dewey, 1921, p. 408.

Arnold has made a careful study of interest from the psychological point of view. He defines interest as "an attitude taken towards a situation, and characterized (1) by motor tendencies and feelings of expectation, anticipation, and strain, (2) by meaning implicit in the situation or by free images and ideas, and (3) by a reference of attitude and ideal content to some future condition of the self."[1] Thus, he recognizes both the motor and ideal aspects of interest. The kinds of interest are classified as: (1) curiosity, (2) expectation, and (3) conscious desire. The three stages of interest are (1) primary, (2) secondary, and (3) acquired. In primary interest, the situation leads directly to pleasure or satisfaction. Secondary interest is interest in means because they are connected with an end that will provide pleasure or satisfaction. These means may eventually come to be interesting on their own account; that would represent acquired interest. All stages of interest may be either positive or negative.

Kitson has investigated interest as a criterion in vocational guidance. The following statements summarize his findings. There are two methods of investigating interests: the "method of expression" and the "method of impression." By the former method, various devices are used to measure involuntary changes in pulse-rate, blood-volume, and respiration and the effort is made to relate the results to feelings of interest. This method is of no real value in vocational guidance. The "method of impression" is the questionnaire method. Kitson is uncertain as to the value of this method. He concludes: "All the evidence shows that the use of interest as a means of directing vocational guidance is beset with many difficulties. They have to do with methods of investigation, with the fact of dearth of interests and the multiplicity of interests, with the fact that interests are unstable, evolving things, and finally, with the fact that interest is not always associated with capacity. Taken together, the difficulties constitute a formidable group of obstacles. They

[1] Arnold, p. 224.

are not unsurmountable, however, if one takes the proper view toward interest. A theory of vocational guidance that regards it as the basic criterion is wrong. It should rightfully be regarded as only one criterion and not at all as the sole or invariably decisive factor. Indeed, no single criterion is adequate for the giving for vocational advice."[1]

Later Kitson developed a new phase of the problem in an article entitled "Economic Implications in the Psychological Doctrine of Interest." He points out its possible significance for the processes of marketing, labor management, and vocational guidance. Interest is defined as "the recognition of a thing which has been vitally connected with experience before—a thing recognized as old" and that which "naturally arouses tendencies to act." He discusses two practical principles of the doctrine of interest: (1) "Interest in a thing may be developed by means of extending information about it;" and (2) "Interest in an object may be developed by arousing motor activity in its behalf."[2] While the writer makes no attempt so to apply them, there is no doubt that both of these principles may be profitably employed in the treatment of vocational interests.

Very few experimental studies of interest have been made. Van Denburg, in studying the causes of the elimination of high school pupils in New York City, tabulated the vocational interests of entering high school pupils. He found that 41% of the boys and 51% of the girls had made no choice. The definite choices were scattering. King made a comparable study of Iowa high school pupils. He found that more than three-fourths of the pupils in all grades of the high schools studied had made definite vocational choices. He attributes this higher percentage to the fact that the early part of the high school work in Iowa affords opportunity for the discovery and cultivation of interests. Sears tabulated the vocational interests of the boys of grades seven and eight of the Oakland schools in 1915. He found that 88% of them made definite choices.

[1] Kitson, 1916.
[2] Kitson, 1920.

In 1913 Thorndike had some college students list a number of school subjects in the order of their preference therefor and later in the order of their ability therein at three different periods: (1) last three years of grammar school; (2) high school period; and (3) college period. He got remarkably high correlations between interest and ability. Of course this study is of suggestive value only. The fact that the preferences of the first and second periods were not the real preferences of those periods, but preferences as remembered some years later renders the actual results highly unreliable. Thorndike concludes that: (1) There is considerable permanence of pupils' interests; (2) that there is an equal permanence of pupils' abilities; and (3) that pupils' interests are highly indicative of their abilities.

Bridges and Dollinger carried on an investigation to check Thorndike's conclusion that pupil's interests are highly indicative of their abilities. College pupils ranked their studies in accordance with their interest and later in accordance with their estimated ability. These records were kept and correlated with the actual marks made for the semester. The interests correlated with the actual marks to the extent of .25; the estimated ability correlated with the marks to the extent of .28; the rank in interest correlated with the rank in estimated ability to the extent of .57. Therefore, they conclude that "a person's relative interests are an extraordinarily inaccurate symptom of his relative capacities."[1]

It must be held in mind that when they speak of capacity, they mean simply capacity in so far as it is revealed by college marks. They suggest that interest and ability must somehow be measured separately.

A. R. Crathorne investigated the vocational interests of 2000 college freshmen in a number of institutions. His purpose was to study the change of mind that takes place between entering high school and entering college. The students were asked to state: Whether they had a definite vocational interest on entering high school; whether they had such a definite in-

[1] Bridges and Dollinger, 1920, p. 313.

terest on entering college; if so, to name it; and, whether it had changed during this period. He found that on entering high school 57% had decided upon their life work. By the time they reached college almost exactly 50% of these had altered their choices. 85% of the students had arrived at definite vocational interests by the time that they entered college. Crathorne's data are open to the same criticism that was made of Thorndike's and their possible value is discounted greatly thereby. With regard to the early interests, it deals, not with the real interests, but the interests as remembered four years later.

Proctor has studied the vocational interests of a group of high school students over a period of four years. There were six hundred eighty-three students available at the end of this period. Two hundred seventy-two were engaged in occupations and two hundred ninety were pursuing work in educational institutions beyond the high school. Of the two hundred seventy-two in vocations, only 40% were engaged in occupations of a rank equal to or higher than that indicated in their original preference. Proctor[1] noted a tendency for the children of less than average intelligence to gravitate to the lower occupations. The median I. Q. of the pupils who had gone on in school was one hundred fifteen; that of those in occupations was one hundred five.

Thorndike has recently reported an interesting study upon "The Disciplinary Values of Studies in the Opinion of Students." He had a large number of teachers and school officers rank various studies and other activities for the disciplinary value which they obtained from them and, later, for the interest which they had in them. For several groups totaling nearly five hundred cases, he gets an unweighted average correlation of .66 with a P. E. of .03 between interest and discipline. He concludes: "On the whole it seems probable that the true resemblance is at least as likely to be above as to be below the resemblance computed from the reports. The discipline for enduring the disagreeable seems

[1] 1923, pp. 79-90.

to be far outweighed by the discipline from working with an interested will along lines that fit one's abilities."[1]

The importance of interest in education is continually growing greater. If we analyze the educational reforms of recent years, we find that their general purpose is to appeal to the children's interests more effectively and so better meet the children's needs.

There is a general recognition of the educational significance of interests, but the experimental study of interests has scarcely been begun.

[1] Thorndike, 1924, p. 143.

CHAPTER II

The Justification of Vocational Guidance in the Junior High School

Vocational guidance is an essential of a democratic system of education. The life of an individual is an organic whole. School life, if it is to function in such a whole, must be vitally connected with the period that precedes it and the one that follows it. We are here concerned with the latter relationship, the chief problem of which will not have been solved until the transfer from school life to after-school life has been facilitated and a sympathetic and intelligent interest in the latter period developed in the minds of the school pupils. Life cannot be an organic whole for those pupils who, on leaving our schools, are hurled, not guided, into an economic world of whose opportunities and demands they are ignorant. Under such conditions their choice of occupation is not based upon reliable information; rather, it is a result of expediency or chance. Dewey[1] says, "A democratic criterion requires us to develop capacity to the point of competency to choose and make its own career." The efficiency of an educational system is judged by the extent of the carry-over of the changes which it has produced in the individual pupils and by the continued growth of the latter. Vocation is the next step after formal education. The extent and content of the education vary enormously among individuals, but the sequence always obtains. Therefore, one of the prime functions of education is its effectual, enlightening, vital connection with vocation. Vocational guidance is the connecting link. If we hold that education in a democracy should be based upon a sympathetic understanding of the interests, abilities, and needs of the individual and that these should be so dealt with that school life becomes a vital, coördinated part of the entire life, then we must grant that vocational

[1] 1921, p. 139.

guidance is one of the most potent mediums available for making our schools democratic.

The democratic aim of education is that there be equal opportunity for all to develop and improve their original abilities and predispositions, however widely these may vary among themselves. An educational system that furnishes a preliminary training for certain vocations and fails to do so for others that are just as legitimate cannot be called democratic. The schools of the past have been designed to provide vocational education for those who planned to pursue professional or semi-professional vocations. More recently vocational training for clerical workers has been undertaken. Democracy demands that this process of extension be made complete, that education be offered for every vocation that is considered legitimate and useful. The scope of the education offered is being broadened continually; but, if maximal service is to be rendered, vocational education must be supplemented by vocational guidance.

Granting that vocational guidance is democratic, we have yet a very serious question to answer. At what stage of the pupil's education shall this guidance be given? One caution must be observed: Guidance cannot be given in a day; but must, to be of any value, be spread out over several years. Guidance without information is not democratic. Guidance must be given while the bulk of the children can yet be reached and not just before the great exodus takes place. This principle definitely determines that democratic vocational guidance must make its appearance earlier than the senior high school period. Thorndike has shown that out of every one hundred pupils finishing the sixth grade, seventy-nine complete the seventh, fifty-nine complete the eighth, and forty complete the ninth.[1] This determines our upper limit. The lower limit is not so easily established. For real vocational guidance, we may ignore the first six grades, but certainly not for vocational information. True sympathy must be based upon broad knowledge. The acquiring of occupa-

[1] Thorndike, 1907, p. 15.

tional information may be made a genuinely cultural study. Somewhere in the grades the pupils must acquire a sympathetic and broad insight into the work of the world. This is essential as a foundation whereon vocational guidance may build. Vocational guidance, to be democratic, must be given in the junior high school. The pupils are then in their early adolescent years. Most of them are near enough to entrance into the economic world to guarantee that genuine vocational activities will be satisfactorily motivated for them. The junior high school was established to meet the needs of these pupils. One of its fundamental aims is to provide exploratory fields for them in order that it may be ascertained whither their capacities, interests, and ambitions best fit them to go. Vocational guidance will complement this exploratory work. Vocational guidance is valuable not alone to those who must very soon become self-supporting, but also to those who will continue their studies. It will give them an opportunity to acquire a sympathetic understanding of the vocations of their fellows who must earn their living largely by the work of their hands. It will tend to clarify, in the minds of the latter, general vocational aims and so enable them to choose better their further preparatory education. Hence, vocational guidance is educationally economical; it implies educational guidance. Children, vocationally informed and guided, will have more reliable and more definite interests and objectives. Also, by meeting the needs of many of the pupils who would otherwise leave school at this period, guidance can reduce the heavy pupil mortality among those who have finished the sixth grade.

Thus vocational guidance in our schools is justified because it is thoroughly democratic in character. Correctly administered, it will tend to break down objectionable class prejudices. Further, it is seen to be most effective when it is provided for the pupils during that critical period in their lives which they spend in the junior high school.

CHAPTER III

The Problem and the Methods

"The changeable nature of interest is a major problem in vocational guidance," says McCall.[1] The present study was undertaken for the purpose of securing a solution for this problem. Specifically, its aim is to ascertain how permanent and how reliable are the vocational interests of pupils entering the junior high schools. The enduring interests of the child are the key to his success in life. But when does he acquire, or develop, these interests? If he already has them when he enters the junior high school, the basis for the work of that institution is presented. If he does not have them, it is the duty of that school to aid him in developing them.

This study was undertaken in the autumn of 1922. The Grade 7B, or entering, pupils in eight of the ten junior high schools of Baltimore were examined. More than sixteen hundred children were included in the study. Two intelligence tests, the Illinois and the Mentimeter, were administered to provide an accurate rating in general ability. The average intelligence quotient used in this study is the unweighted average derived from the results of these two tests. The Toops I. E. R. Clerical Test Form 1 and the Stenquist Mechanical Test Form 1 were given in order to secure a measure of certain more or less specific capacities of the pupils. An interest questionnaire (See Appendix 1)[2] was devised for the purpose of studying the vocational, recreational, subject-matter, and work interests of the pupils.[3] The first questionnaire was filled out in December, 1922. Three follow-up questionnaires were given: One in May, 1923, toward the end of the semester spent by most of the pupils in Grade 7A; a second early in October, 1923, shortly

[1] 1918, p. 185.

[2] A copy of the final questionnaire is given there because it includes all the essential questions of the previous ones and one added feature.

[3] The Work Interests Test was borrowed from the Work Interest Blank developed by Dr. Miner, of The Carnegie Institute of Technology.

after the end of the summer vacation; and a third in December, 1923, one year after the original.

Vocational guidance cannot be successful through the following of interests alone. There are two conditioning factors: (1) The abilities of the pupils; and (2) the occupational opportunities available.[1] The first of these is here taken into consideration by studying the pupils' interests by means of a classification based upon the average intelligence quotients of the pupils. We have the average intelligence quotients for the pupils of all but one school; in that only the Mentimeter Test was given. Sixteen hundred forty-four pupils filled out the original questionnaire. The intelligence quotients of fourteen hundred sixty-seven of these were available. These latter thus constituted the cases upon which the study is based. They were distributed into five groups as follows: 1, the highest decile; 2, 3, the second and third highest deciles; 4, 5, 6, 7, the middle four deciles; 8, 9, the third and second lowest deciles; and 10, the lowest decile. These numbers will be used to signify the several groups throughout the study. This distribution shows the following I. Q. limits for the several groups. (All I. Q. numbers are inclusive.)

TABLE 1

Decile group	I. Q. limits
1	132–163
2, 3	117–131
4, 5, 6, 7	95–116
8, 9	83– 94
10	52– 82

The average I. Q. for all of the children examined was approximately 105.

The following table gives the number of cases in each group and the sex distribution for each. The ideal distributions follow.

[1] This second factor was not found susceptible to satisfactory treatment in this study.

TABLE 2

Decile group	Obtained distribution			Ideal distribution		
	Boys	Girls	Total	Boys	Girls	Total
1	85	60	145	71	76	147
2, 3	157	135	292	142	152	294
4, 5, 6, 7.....	272	320	592	282	303	585
8, 9	127	164	291	142	152	294
10	67	80	147	71	76	147
	708	759	1467	708	759	1467

This indicates that the obtained total distribution approximates the ideal one. However, the sex distribution is not normal. Combining the two upper groups and calling them the A (above-average) group, the two lower groups and calling them the B (below-average) group, and designating the middle group as M, we get the following table:

TABLE 3

Groups	Numerical distribution				Percentage of displacement	
	Boys		Girls			
	Actual number	Ideal number	Actual number	Ideal number	Boys	Girls
A	242	213	195	228	+13	—14
M	272	282	320	303	— 4	+ 6
B	194	213	244	228	— 9	+ 7
Totals .	708	708	759	759		

These figures show that for this group the boys are markedly superior to the girls in general intelligence as measured by the two tests used.

The next problem to present itself for solution was the classification of occupations. No classification reported in the past proved entirely satisfactory. The classification had to be comprehensive, yet not unwieldy. Eventually a fifteen-fold classification was worked out. The following divisions were decided upon: Agriculture, Manufacturing, Mechanical Industries, Transportation, Trade, Public Service, Engineers, Physicians, Lawyers and Judges, Teachers, Entertainers and Artists, Other Professional Services, Domestic and Personal Services, Clerical Workers, and No Choice. Several explanatory notes must be given. Manufacturing here has reference

to operatives. Trade indicates business activities, not the work of mechanics. The professions are divided in six groups because the amount and kind of training required for the several professions varies greatly. Where there was any doubt about the classification of any particular occupation, the Government Census classification was consulted and followed.

The data are tabulated in double-entry tables. Each table shows the relationship between the results of two sets of questionnaires. The records for the boys are kept separate from those for the girls. The rows indicate the choices for one period and the columns, those for the other. Hence, the entry for any pupil who makes the same choice on both occasions will appear in the diagonal of boxes extending from the upper left-hand corner of the table to the lower right-hand corner. This is spoken of as the "diagonal of permanency." The number of cases appearing in this diagonal divided by the total number entered in the table gives the percentage of permanency. In all the permanency tables, the number in the upper left hand corner of a box represents the boys; the number in the lower right-hand corner represents the girls.

CHAPTER IV

The Original Distribution of Vocational Choices

The following table gives the vocational distribution, in percentages, of the entire group of boys and girls who filled out the first questionnaire.

TABLE 4

Occupational group	Boys %	Girls %
Agriculture	.6	.1
Manufacturing	1.8	2.6
Mechanical industries	20.5	1.1
Transportation	1.6	1.0
Trade	11.1	2.3
Public service	1.1	0
Engineers	21.5	0
Physicians	8.1	.7
Lawyers and judges	6.5	1.5
Teachers	1.3	27.6
Entertainers and artists	3.2	4.3
Other professions	12.6	6.7
Domestic and personal	0	.3
Clerical	8.4	49.9
No choice	1.7	1.9
Total	100.0	100.0

To aid us in observing the tendencies as they vary from decile to decile, a more compact grouping will be serviceable. The following combinations and changes are effected:

(1) The six classes of professions are combined.

(2) Mechanical Industries, Manufacturing, and Agriculture are combined under the first mentioned name.

(3) General Service includes: Transportation, Public Service, and Domestic and Personal Service.

TABLE 5

BOYS

	Highest decile %	2d and 3d %	Middle four %	8th and 9th %	Lowest %	All deciles %
1. Professions	59	64	55	43.5	31	53
2. Trade	11	9.5	10	10.5	19	11
3. Mechanical industries	15	17.5	22	29	39	23
4. Clerical work	8	4	10	12	8	8
5. General service	6	2.5	1	4	3	3
6. No choice	1	2.5	2	1	0	2

GIRLS

	Highest decile %	2d and 3d %	Middle four %	8th and 9th %	Lowest %	All deciles %
1. Professions	68	56	42	29	17	41
2. Trade	2	2	1	2	7.5	2
3. Mechanical industries	3.5	4	3	6.5	2.5	4
4. Clerical work	21	37	50	60	70.5	50
5. General service	2	0	1	1	2.5	1
6. No choice	3.5	1	3	1.5	0	2

The most striking fact revealed by Table 4 is the marked difference in the spread of choices between the sexes. Of the fourteen groups, the boys have more than 5% in seven of them. The girls exceed 5% in only three groups. The two most favored groups among the girls draw 75% of the choices. We must include the six most favored groups among the boys to reach this percentage. This seems to indicate that a girl's vocational outlook is much more restricted than a boy's.

The decile table for boys shows that the percentage of professional choices is pretty constant among the two upper and the large middle groups. Then this percentage falls off abruptly. Trade remains constant throughout, save in the lowest decile where a sharp rise is noted. The choice of mechanical industries shows a constant tendency to vary inversely with intelligence. Judging by these figures, we may say that the lower the intelligence, the greater is the likelihood that a boy will be interested in becoming a mechanic. Clerical choices are fairly constant throughout, as are those for General Service.

Among the girls Trade, General Service, and Mechanical Industries are constant and unimportant. Professional preferences show a marked and steady decrease with diminished intelligence. Clerical preferences show an even more marked rise with diminished intelligence. These statements suggest that girls' preferences for teaching and clerical work have a direct relationship to intelligence. The following table gives the facts:

TABLE 6

	Percentage of girls choosing teaching	Percentage of girls choosing clerical work	Percentage of girls choosing something else
1. Highest decile ..	43	21	36
2. 2d and 3d.....	37	37	26
3. Middle four ...	30	50	20
4. 8th and 9th.....	19	60	21
5. Lowest	10	70	20
Total group ..	27	50	23

The evidence is conclusive and striking. The girls of higher intelligence are far more likely to select teaching than the others. Also, those of higher intelligence are the more likely to choose some vocation other than one of these two. There seems to be a crying need for vocational guidance here in regard to these clerical choices. Not only must many aspirants be disappointed in their hopes because the supply exceeds the demand, but many are not qualified to succeed were there unlimited opportunities. Vocational guidance must meet their needs early if it is to assure any real economic success.

CHAPTER V

THE PERMANENCY FROM GRADE 7B TO GRADE 7A

The first follow-up questionnaire was given in May, 1923, one semester later than the original one. Of the original fourteen hundred sixty-seven pupils, twelve hundred fifty-eight filled out this questionnaire. The following table shows how the eliminations were distributed.

TABLE 7

ELIMINATIONS FROM DECEMBER, 1922, TO MAY, 1923

Decile group	Number			Percentage		
	Boys	Girls	Total	Boys	Girls	Total
1	11	14	25	13	23	17
2, 3	10	20	30	6	15	10
4, 5, 6, 7	15	12	27	6	4	5
8, 9	45	40	85	35	24	29
10	21	21	42	31	26	29
Total	102	107	209	14	14	14

The follow-up technique used with later questionnaires was not fully developed for this one; therefore, it is probable that the eliminations are unduly large. This point will be discussed later at greater length.

Table 8 gives in detail the relationship of the original choices to those expressed by the pupils in May.[1] In Table 9 the percentages of permanency for the several decile groups are presented.

[1] Tables giving the relationship for each decile group separately are included in the original copy of this study, which is on file with the librarian of The Johns Hopkins University.

TABLE 8

VOCATIONAL CHOICES OF ENTIRE GROUP FROM DECEMBER, 1922, TO MAY, 1923

CHOICES—MAY, 1923

CHOICES—DECEMBER, 1922

Choices	Agriculture	Manufacturing	Mechanical industries	Transportation	Trade	Public service	Engineers	Physicians	Lawyers and judges	Teachers	Entertainers and artists	Other professional service	Domestic and personal	Clerical service	No choice	Boys	Girls	Totals
Agriculture	5		1													6	0	6
Manufacturing		2 3					1	1		1		1		1		5	5	10
Mechanical industries			76 1		6	1	20	2	5			7		5 2	2	124	3	127
Transportation			1	1	1							1		1		2	3	5
Trade	2	1	10	2	32 8		4	1	5	1	1	8		4 10	3 1	70	23	93
Public service			1	1		2	1									5	0	5
Engineers			19	1	5		91	4	1			19		2	2	144	0	144
Physicians	2		2		1		3	30 2	2	1	1	2 1		1 1		44	5	49
Lawyers and judges			4		1		3	2	31 3	4		4		1 2		46	9	55
Teachers	2	1	1		1		1	1	1	2 145	2	2 4	4	1 31	4	8	195	203
Entertainers and artists					3			1		1 3	6 25	3 3	1	1 3	1	15	36	51
Other professional service		1	4	2	1 1		7	8	2	1 7	2 1	49 19	1	5 2	1 4	80	38	118
Domestic and personal					1					1				1		0	3	3
Clerical service			11	4	4	1	4	2	1	38	1 5	4 2		22 264	1 1	46	319	365
No choice	1		2				2	1	1	3			4	2	5 3	11	13	24
Boys	12	2	131	2	49	4	137	52	46	4	11	100	0	42	14	606		
Girls	0	6	2	9	16	0	0	3	6	204	33	29	10	320	14		652	
Totals	12	8	133	11	65	4	137	55	52	208	44	129	10	362	28			1258

PERMANENCY

	No. cases	Percentages
Boys	353	58.2
Girls	474	72.7
Total group	827	65.7

TABLE 9

VOCATIONAL INTERESTS FROM DECEMBER, 1922, TO MAY, 1923

PERCENTAGES OF PERMANENCY

Decile groups	Boys	Girls	Total
1	58	65	60
2, 3	67	73	69
4, 5, 6, 7.....	59	74	67
8, 9	45	75	63
10	54	64	60
Total	58.2	72.7	65.7

Intelligence does not seem to have any clear-cut relationship to permanence. The percentages are fairly constant throughout the five groups. However, the girls consistently show a much higher percentage of permanency than do the boys. We have already shown that the girls' choices are restricted to far fewer groups than are the boys'. This fact seems sufficiently potent to account for the difference. A greater number of possible choices means finer gradations. Finer gradations permit easier transfer from one group to another. Easier transfer means diminished permanence.

The total percentage of 65.7% seems rather high. However, no previous studies have given standards[1] whereby we may make comparisons. The results obtained from the three other kinds of interests here studied may be used for this purpose. However, in all three of them, the choice was more or less controlled, while in the vocational interests, it was absolutely uncontrolled. Comparable results are presented in the tables that follow:

[1] Since this was written, McCracken and Lamb have published a book, entitled "Occupational Information in the Elementary School," in which certain somewhat similar results are reported. For 53 seventh grade junior high school boys and 100 girls, they received a permanency percentage of 56.6% for the boys and 46% for the girls for a period lasting slightly more than a year during which three choices were made.

TABLE 10

FAVORITE STUDIES (13 GROUPS[1])

PERCENTAGES OF PERMANENCY

Decile groups	Boys	Girls	Total
1	42	42	42
2, 3	35	36	35
4, 5, 6, 7	35	41	38
8, 9	44	34	38
10	25	35	31
Total	36	37	37

Here we find that the choices of the boys and girls are practically of equal permanence. It is interesting to note that the range of possible choices is equally great for both girls and boys in regard to school subjects.

TABLE 11

FAVORITE KINDS OF ENTERTAINMENT (12 GROUPS[1])

PERCENTAGES OF PERMANENCY

Decile groups	Boys	Girls	Total
1	42	49	44
2, 3	36	40	38
4, 5, 6, 7	44	33	38
8, 9	38	36	37
10	54	34	43
Total	41	36	39

It will be noted in this table that, where girls and boys have an equally unrestricted choice, the boys' interests are markedly more permanent than the girls'. So we cannot say that girls are naturally less likely to change their interests than boys.

TABLE 12

FAVORITE KINDS OF ACTIVITY (23 GROUPS[1])

PERCENTAGES OF PERMANENCY

Decile groups	Boys	Girls	Total
1	34	57	44
2, 3	30	51	39
4, 5, 6, 7	30	40	36
8, 9	23	31	28
10	30	24	27
Total	29	40	34

[1] See Appendix 1.

Here once more we are dealing with vocational choices. The greater restriction of the girls again plays a part. In no single group do we find more than 15% of the boys' choices; in one group there are over 30% of the girls'.[1] Fifteen different groups have been selected by ten or more boys; in only eleven groups are ten or more girls represented.[1] Hence, for the reason previously expressed, we should expect the girls' permanency percentage to be higher than the boys' and we are not disappointed as the table reveals a difference in their favor of 11%. The fact that none of these controlled interests shows a percentage of permanency two-thirds as high as that of the uncontrolled vocational interests permits us to consider the latter as quite significant.[2]

The gross distribution of vocational choices made in May corresponds very closely with that of the previous December. The two distributions are 91.9% identical. Ranking the fifteen groups and applying the Spearman Rank-Difference formula, we get $\rho = .956$, which is equivalent to a Pearson r of .96. These figures indicate that there is some equalizing principle at work. While one-third of the individual pupils change their choices, the entire distribution alters less than 10%.

[1] The table showing this distribution is not included.
[2] See Chapter XIII, pp. 54-55.

CHAPTER VI

The Effect of a Summer Vacation on Pupils' Vocational Interests

Determination of the percentage of permanency of children's vocational interests is one problem; determination of the causes for their changes in interests is another. When we come to analyze the latter problem into the factors involved, the most valuable classification is that based upon the sources of these causes. Are these sources within or without the school? The former will predominate during the school year, the latter during the summer vacation. For the purpose of obtaining light upon this question, the questionnaire was given to the pupils again early in October, 1923, shortly after their summer vacation. This questionnaire represented the bulk of those examined as beginning Grade 8B pupils, but some had been retarded and were scattered through 7A and 7B classes. However, all are treated in this study.

The details are given in Table 14.[1] The following table presents a summary of them.

TABLE 13

Permanency of Vocational Interests from May, 1923, to October, 1923

PERCENTAGES OF PERMANENCY

Decile groups	Boys	Girls	Totals
1	84	87	85
2, 3	74	83	78
4, 5, 6, 7	71	81	77
8, 9	66	78	73
10	72	87	80
Total	73.2	82.0	77.8

The period from December to May and that from May to October are of very similar length and, to that extent, com-

[1] Tables giving the relationship for each decile group separately are included in the original copy of this study, which is on file with the librarian of The Johns Hopkins University.

TABLE 14

VOCATIONAL CHOICES OF ENTIRE GROUP FROM MAY, 1923, TO OCTOBER, 1923

CHOICES—OCTOBER, 1923

CHOICES—MAY, 1923

Choices	Agriculture	Manufacturing	Mechanical industries	Transportation	Trade	Public service	Engineers	Physicians	Lawyers and judges	Teachers	Entertainers and artists	Other professional service	Domestic and personal	Clerical service	No choice	Boys	Girls	Totals
Agriculture	7		1		1						1					10	0	10
Manufacturing		2										1				3	0	3
Mechanical industries			53		5		15		2			4		3	1	83	0	83
Transportation				1 1										2		1	3	4
Trade			2		28 2	1	2			2		3		4 4		40	8	48
Public service			1			3										4	0	4
Engineers			13		4	1	96					7			1	122	0	122
Physicians			2				1	26 1	5 1		1	7		1 1		43	3	46
Lawyers and judges					3			2	36 5			2		2		45	5	50
Teachers								1	2	2 162	1 3	6		12	1	3	187	190
Entertainers and artists					1 1					6	9 25	1		2 3		12	36	48
Other professional service	1		2		4		6	1	1 1	2		63 11		1 4	1 1	80	19	99
Domestic and personal										5		1	4	1		0	11	11
Clerical service			1		2 2			1		12	1 7	3	2	30 227	1	35	254	289
No choice			1		1		1			2	3	1 1		2 3	2 3	8	12	20
Boys	8	2	76	1	49	5	121	29	44	2	13	88	0	45	6	489		
Girls	0	0	0	1	5	0	0	3	9	191	38	23	6	257	5		538	
Totals	8	2	76	2	54	5	121	32	53	193	51	111	6	302	11			1027

PERMANENCY

	No. cases.	Percentages.
Boys	358	73.2
Girls	441	82.0
Total group	799	77.8

parable. The permanency for the second period shows a gain of more than 12% over that for the first. The boys gain 15% in permanence, while the girls are gaining 9.3%. These figures show that very slight changes take place in pupils' vocational interests during the summer vacation. These interests are either not considered, or the activities and environment of the pupils tend to fix, rather than to change, them. There seems to be revealed a slight tendency indicating that the more intelligent a pupil is, the more likely he is to stick to his vocational choice over the summer.

The inadequate follow-up in May and the ordinary dropping out of pupils between the seventh and eighth grades combined to reduce the figures for this distribution to one thousand twenty-seven pupils.

CHAPTER VII

The Combined Effect of a Period Covering Half a Year's School Work and a Summer Vacation

From this third questionnaire we may also derive the percentages of permanency for the period extending from December, 1922, to October, 1923. They will represent the combined effects upon the pupils' interests of one semester in school and a summer vacation. The percentage of permanency for the entire group for this period of ten months is 66.1%, a slight gain over that for the first period of five months. However, the most striking point revealed by this comparison is the high constancy of the percentage of permanency. Analyzing the comparative distributions for sex differences in permanency, we find the girls 1.3% lower than before and the boys 1.9% higher, the difference between the two being thus reduced from 13.5% to 11.2%. The detailed distribution is given in Table 16.[1] The results are summarized in Table 15.

TABLE 15

Percentages of Permanency from December, 1922, to October, 1923

Decile groups	Boys	Girls	Totals
1	63	73	67
2, 3	67	70	68
4, 5, 6, 7.....	56	76	65
8, 9	61	70	66
10	54	68	62
Totals ...	60.1	71.4	66.1

The percentages shown in Table 15 indicate that there is practically no relationship between intelligence and the permanence of vocational interests.

The two total distributions here under consideration are 89.5% identical. If the fifteen vocational groups for each are ranked, a Spearman $\rho = .95$, equivalent to a Pearson $r = .954$. is secured. These figures show that the distribution of choices expressed in the third questionnaire is not quite as closely related to the original distribution as is that of those expressed in the second questionnaire.

[1] Tables giving the relationship for each decile group separately are included in the original copy of this study, which is on file with the librarian of The Johns Hopkins University.

TABLE 16

VOCATIONAL CHOICES OF ENTIRE GROUP FROM DECEMBER, 1922, TO OCTOBER, 1923

CHOICES—OCTOBER, 1923

CHOICES—DECEMBER, 1922

Choices	Agriculture	Manufacturing	Mechanical industries	Transportation	Trade	Public service	Engineers	Physicians	Lawyers and judges	Teachers	Entertainers and artists	Other professional service	Domestic and personal	Clerical service	No choice	Boys	Girls	Totals
Agriculture	4		1								1					6	0	6
Manufacturing		2			1							1		1		4	1	5
Mechanical industries			54		6	1	19	1	2			5		9	2	99	0	99
Transportation				1								1		5		1	6	7
Trade	1		4		32 2	1	6	1	1	2	1	9		3 7	1	60	11	71
Public service			1			2	2									5	0	5
Engineers			13	1	4	1	81	2	4			19		4	1	130	0	130
Physicians	1		4		1		4	26 1	3 1	1	1	7		2 2		49	5	54
Lawyers and judges			1		2		2	1	33 5	3		2 1		2 2		43	11	54
Teachers	1				3				3	1 151	5	10		1 29	1	3	202	205
Entertainers and artists			1					1		8	7 31	3 1		1 7	1	12	49	61
Other professional service			3		1 1		6	4	2	1 9	2 1	58 11		4 6	1	82	28	110
Domestic and personal													1	1		0	2	2
Clerical service			5		2	1	5	1 1	1	39	1 6	2 8	2	26 237	1	44	294	338
No choice	1		2		1		1	1	1	2	1		3	1	2 2	8	10	18
Boys	8	2	89	1	50	6	126	36	46	2	13	107	0	52	8	546		
Girls	0	0	0	1	6	0	0	4	10	215	44	31	6	298	4		619	
Totals	8	2	89	2	56	6	126	40	56	217	57	138	6	350	12			1165

PERMANENCY

	No. cases.	Percentages.
Boys	328	60.1
Girls	442	71.4
Total group	770	66.1

CHAPTER VIII

The Effect of One Year on the Original Choices

The third follow-up questionnaire was administered in December, 1923, one year after the original questionnaire. The percentage of permanency for the entire group is 66.7%, being slightly higher than that secured for either of the two shorter periods, (1) December to May and (2) December to October. The detailed distribution is presented in Table 19.[1] The results are summarized in Table 17.

TABLE 17

Percentages of Permanency for the Entire Year

Decile groups	Boys	Girls	Totals
1	65	63	64
2, 3	64	69	67
4, 5, 6, 7.....	60	73	68
8, 9	60	76	71
10	55	54	54
Totals ...	61.6	70.8	66.7

If we exclude the lowest decile group, there seems to be a slight negative relationship here obtaining between intelligence and the degree of permanence of interest.

There seems to be a marked tendency for the difference in permanence between the girls' interests and the boys' interests to be gradually diminished. The figures for the three follow-ups are presented in Table 18.

TABLE 18

Sex Differences in Permanence

	Boys %	Girls %	Difference %
Dec., '22, to May, '23.....	58.2	72.7	14.5
Dec., '22, to Oct., '23.....	60.1	71.4	11.3
Dec., '22, to Dec., '23.....	61.6	70.8	9.2

The fact that two-thirds of the children have the same interest after the lapse of a year indicates that these interests

[1] Tables giving the relationship for each decile group separately are included in the original copy of this study, which is on file with the librarian of The Johns Hopkins University.

TABLE 19

VOCATIONAL CHOICES OF ENTIRE GROUP FROM DECEMBER, 1922, TO DECEMBER, 1923

CHOICES—DECEMBER, 1923

CHOICES—DECEMBER, 1922

Choices	Agriculture	Manufacturing	Mechanical industries	Transportation	Trade	Public service	Engineers	Physicians	Lawyers and judges	Teachers	Entertainers and artists	Other professional service	Domestic and personal	Clerical service	No choice	Boys	Girls	Totals
Agriculture	5		1	1												7	0	7
Manufacturing		1										2				3	0	3
Mechanical industries			49		5		17	1	2		1	9		7		91	0	91
Transportation				1 2	1					1	1			1		3	4	7
Trade	1		4	1	32	1	4	1		1		7		1 6	1	53	7	60
Public service						5						1				6	0	6
Engineers	1		10	1	2		75	1	7	1		11		4	2	115	0	115
Physicians			3		1	1	1	31	1 1	1		4	1	2 1		44	4	48
Lawyers and judges			3		2			2	30 3	4	1	2		1 2	1	42	9	51
Teachers					1 1				5	2 141	7	6		34	1	3	195	198
Entertainers and artists	1		1		1 1			1		10	7 30	3	1	3 11		16	54	70
Other professional service	1		1		1	1	6	1	2	11	3 2	49 15		5 7	4	74	35	109
Domestic and personal													2	2		0	4	4
Clerical service	1		5 1	1	1		2		1	1 33	1 6	5 6	1	18 236	1	34	286	320
No choice			1			1	2	1		1	3	2		1	1	4	9	13
Boys	9	1	78	4	46	8	107	39	42	4	14	93	0	41	9	495		
Girls	1	0	1	3	3	1	0	0	10	203	48	29	5	301	2		607	
Totals	10	1	79	7	49	9	107	39	52	207	62	122	5	342	11			1102

PERMANENCY

	No. cases.	Percentages.
Boys	305	61.6
Girls	430	70.8
Total group	735	66.7

are of value and that they must be taken into consideration in vocational guidance. The reliability of these data will be discussed in a later chapter.

The original and the fourth distributions are 90.6% identical. This shows that the compensatory factor previously noticed is still at work. If the groups of both distributions are ranked and the Spearman Rank-Difference formula applied, we get a $\rho = .987$, which is equivalent to a Pearson r of .988. The ranking in favor of the fifteen groups is practically constant at all four testing periods.

CHAPTER IX

The Interests and the Intelligence of the Eliminated Pupils

During the year which this study covers, three hundred sixty-five pupils, or one-fourth of the original group, were eliminated. One of the chief purposes of the junior high school is to reduce the early pupil exodus as greatly as possible. Therefore an explanation of these losses is most pertinent. Can it be that the junior high school is not appealing to the interests of these children who leave so early? An analysis of the vocational interests that they expressed on the first questionnaire may help us to answer this question. Table 20 shows the distribution of their original choices among the fifteen vocation groups.

TABLE 20

Vocational Interests of the Eliminated Pupils

Vocational Group	Boys	Girls	Total group
Agriculture	0	0	0
Manufacturing	0	0	0
Mechanical industries	75	0	75
Transportation	3	4	7
Trade	37	9	46
Public service	3	0	3
Engineers	40	0	40
Physicians	6	0	6
Lawyers	8	1	9
Teachers	0	25	25
Entertainers and artists.	5	6	11
Other professions	14	10	24
Domestic and personal..	0	1	1
Clerical	20	94	114
No choice	2	2	4
Totals	213	152	365

This gross distribution shows that the choices are by no means evenly divided among the several groups. Its meaning may be more easily grasped if we know the percentage of those originally choosing each specific group that has been eliminated. The following tables will give this information for the boys and girls separately.

TABLE 21

ELIMINATION AMONG THE BOYS

(Showing percentage of each group that was eliminated)

		%	
Transportation	(6)[1]	50	
Mechanical industries ..	(166)	45	
Trade	(90)	41	
Clerical work	(54)	37	
No choice	(6)	33	
Public service	(9)	33	
Engineers	(155)	26	30% elimination
Entertainers and artists.	(21)	24	for entire group.
Lawyers	(50)	16	
Other professions	(88)	16	
Physicians	(50)	12	
Teachers	(3)	0	
Agriculture	(7)	0	
Manufacturing	(3)	0	

[1] The numbers in the parentheses show how many boys' interests originally fell in each group.

This table seems to tell a very straightforward story. We may neglect the six groups that failed to attract as many as ten boys. They are statistically worthless. Then we see that all those groups wherein the eliminations are below the percentage for the entire group are professional while all those wherein they are above the average are non-professional. Less than 20% of the boys with professional ambitions leave school during the year; more than 44% of those with non-professional aims do so. *A lofty interest holds the pupil in the school.* Those who are interested in vocations, entrance to which is dependent upon long and exacting educational preparation, tend to stay in school. Those who are interested in the less exacting vocations tend to drop out. Do these latter pupils feel that they are sufficiently trained to succeed in their chosen calling? Or do they feel that the school has nothing further of value to offer them? Four-fifths of this group are interested in becoming mechanics or tradesmen. The duty of the junior high toward them is as yet largely an unsolved problem.

We must now look at the other side of the picture and see what part interest plays in the eliminations of the girls.

TABLE 22

ELIMINATION AMONG THE GIRLS

(Showing percentage of each group that was eliminated)

		%	
Trade	(16)[1]	56	
Transportation	(8)	50	
Clerical work	(380)	25	
Other professions	(45)	22	
Domestic and personal.	(5)	20	20% elimination
No choice	(11)	18	for entire group.
Teachers	(220)	11	
Lawyers	(10)	10	
Entertainers and artists.	(60)	10	
Physicians	(4)	0	

[1] The numbers in the parentheses show how many girls' interests originally fell in each group.

The interpretation here is not quite so simple. The very small groups must be ignored as usual. It is necessary to remember that three-fourths of the girls are interested in two of the groups—clerical work and teaching. Of these the girl expressing a choice for clerical work is 25% more likely to drop out than the average girl. The one who wishes to teach is little more than half as likely to do so as the average girl. The same tendency seems here revealed as was shown in the cases of the boys. 12% of the girls with professional ambitions are eliminated as against 26% of those with non-professional interests. *Interest is undoubtedly a significant factor in pupil elimination.*

There are at least two other possible causal factors involved in elimination that will repay study. They are economic pressure and ability to do the work. With the data at hand we can get at the former only indirectly. However, the intelligence ratings give us a definite basis for investigating the latter. The eliminations for two periods will be studied: (1) from December, 1922, to October, 1923; and (2) from December, 1922, to December, 1923. For these two periods the follow-up technique was sufficiently developed to provide a reliable measure of the actual elimination. One hundred thirty-eight cases, which had not been reached in May, were recovered in October. During the period from December to

October there were three hundred two withdrawals. This represents 21% of the original group. They are distributed in respect to intelligence and sex in the following table:

TABLE 23

ELIMINATIONS DURING DECEMBER TO OCTOBER PERIOD

Decile groups	Expressed in numbers			Expressed in percentages		
	Boys	Girls	Total	Boys	Girls	Total
1	3	1	4	4	2	3
2, 3	22	22	44	14	16	15
4, 5, 6, 7.....	37	20	57	14	6	10
8, 9	61	55	116	48	34	40
10	39	42	81	58	53	55
Totals ...	162	140	302	23	18	21

Economic pressure would naturally inflict a heavier toll upon the boys than upon the girls. This expectation is here corroborated; a boy's chance of staying in school during this period is 94% as good as a girl's. This seems to indicate that economic pressure is not a deciding factor. A glance at the table suggests that intelligence may afford the clue. For convenience we may call the first, second, and third deciles the A (above-average) group; the middle four deciles the M (middle) group; the eighth, ninth, and tenth deciles the B (below-average) group. The percentage of elimination in each group follows:

Group	Boys %	Girls %
A	10	11
M	14	6
B	51	40

Here the story in clear. The A and the M groups are very similar, but the B group has nothing in common with them. A boy with "B" intelligence is five times as likely to be eliminated as a boy of "A" intelligence. For the girls the corresponding figures are approximately four to one. Also, a girl with "B" intelligence is four times as likely to be eliminated as an "A" boy. More than 65% of the withdrawals occur in the B group, or lowest 30% of the pupils; *i. e.*, 217% of the number which this group would be expected

to furnish if it were entirely a matter of chance and intelligence were a negligible factor.

Before drawing further conclusions, we should examine the results for the entire year.

TABLE 24

ELIMINATIONS DURING ONE-YEAR PERIOD

Decile groups	Expressed in numbers			Expressed in percentages		
	Boys	Girls	Total	Boys	Girls	Total
1	6	0	6	7	0	4
2, 3	35	18	53	22	13	18
4, 5, 6, 7.....	51	36	87	19	11	15
8, 9	74	57	131	58	35	45
10	47	41	88	70	51	60
Totals	213	152	365	30	20	25

During the entire year one-fourth of the pupils studied are eliminated. Three-fifths of these are boys. In other words, a boy's chance of staying in school is seven-eighths as good as a girl's. To study the influence of intelligence, we may again use the threefold classification suggested above.

PERCENTAGES OF ELIMINATION

Group	Boys %	Girls %
A	17	9
M	19	11
B	62	40

In the main this table tells the same story as the previous one. The "B" group furnishes 60% of the eliminated pupils, or just twice as many, as would be expected if intelligence were a negligible factor. Less than one-sixth of the eliminations are in the "A" group. A boy of superior intelligence is not half as likely to withdraw as a girl of inferior capacity. Therefore, we are justified in relegating economic pressure to a relatively unimportant place in studying eliminations and in placing maximum emphasis upon the ascertainment of intelligence.

Only one more fact remains to be considered. By October the percentage of boys eliminated was little more than one-

fourth greater than that of girls. By December this difference had increased until it was half again as great. What is the reason for this? During Grade 7B all the children take an undifferentiated course. Several elective courses are offered during Grade 7A. During this year, the percentages representative of these two grades (7B and 7A) have been very similar. In Grade 8B, the pupils are permitted to specialize more markedly. It was during this period of marked differentation that the school's holding power decreased so greatly in the case of the boys in comparison with that of the girls. It may be that there are not enough courses offered to appeal to the interests of the boys. Or, in light of the fact that four-fifths of these boys are interested in becoming mechanics or tradesmen, it may be that they feel that they have sufficient school training for their chosen vocations. No data are at hand to establish a satisfactory explanation. However, we may conclude that the vocational interests and the intelligence of pupils are exceedingly significant and potent factors in determining how long the pupils will remain in school.

CHAPTER X

Are the Interests Expressed of Practical Value?

If we can determine whether or not the interests expressed function in every-day life we shall have a valid measure of their vitality. Inasmuch as the pupils are not yet engaged in their vocations, our field of investigation must be limited to school activities. Do these interests guide the pupils in their making of decisions? The most important decision that a pupil must make during his junior high school career is to choose which course of three—academic, commercial, and industrial—he will pursue. This choice is made at the beginning of the second half-year; *i. e.*, at the beginning of Grade 7A. If a pupil's selection proves obviously incorrect, he is permitted to transfer to another course. However, the percentage of transfers is really very low. In order that the vitality of their interests might be studied, the children were asked to indicate on the last questionnaire what course they were pursuing. Only six pupils out of the one thousand one hundred two failed to do so. What relation does their selection of courses bear to their avowed vocational interests? In order to answer this question, the data were tabulated in double-entry tables. What course must a pupil with a given interest take in order that he may best prepare himself for his desired work? That this latter question might be satisfactorily answered it was necessary to study the several vocational groups and work out a classification of correspondence. This classification follows:

The academic course is the proper one for those interested in the following vocational groups: Trade, public service, physicians, lawyers, teaching, entertainers and artists, other professional services, transportation, domestic and personal services, engineering and no choice.

The commercial course is the proper one for those desiring to enter the following vocation: Clerical services.

The industrial course is the proper one for those interested in entering the following vocations: Agriculture, manufacturing, mechanical industries, and engineering.

Both the academic and industrial courses were considered a satisfactory preparation for engineering because pupils who have completed either course are eligible to enter the Polytechnic Institute, the technical high school of Baltimore. However, the investigation showed that nearly all the boys who desired to be engineers were taking the industrial course.

Table 26 shows the distributions of these data tabulated for the entire group.[1] The percentage of agreement between vocational interest and course selected is very high, 92.2%. Even this figure is probably too low. The rigidity of the classification caused some few choices to be classified as illogical which were probably not really so. For example, several boys who wished to become architects (therefore being classified in the "Other Professional Group") are taking the industrial course. Inasmuch as this course gives them mechanical drawing, they are probably right in their choice, yet our classification records them as pupils making illogical selections. We may say that pupils' vocational interests function in nearly every case in their making of the most significant decision required of them during their three-year course.

The percentages of agreement do not vary greatly from decile to decile.

TABLE 25

VOCATIONAL INTEREST AND SELECTED COURSE

PERCENTAGE OF IDENTITY

Decile groups	Boys %	Girls %	Total %
1	92.4	91.6	92.0
2, 3	91.8	93.0	92.4
4, 5, 6, 7.....	91.8	93.0	92.4
8, 9	90.6	92.5	91.9
10	90.0	89.7	89.8
Total	91.7	92.7	92.2

[1] Tables giving the distribution for each decile group separately are included in the original copy of this study, which is on file with the librarian of The Johns Hopkins University.

There is no appreciable difference between the percentages of the boys and those of the girls. Therefore, we may conclude that there is an unusually high relationship extant between vocational interest and school course selected and that it is conditioned by neither intelligence nor sex.

TABLE 26

RELATIONSHIP BETWEEN INTEREST EXPRESSED AND COURSE SELECTED

ENTIRE GROUP

INTEREST EXPRESSED

COURSE SELECTED	Academic	Commercial	Industrial	Boys	Girls	Total
Academic	213 / 278	5 / 29	11 / 1	229	308	537
Commercial	6 / 15	52 / 280	7	65	295	360
Industrial	10	2	187	199	0	199
Boys	229	59	205	493		
Girls	293	309	1		603	
Total	522	368	206			1096

PERCENTAGES OF IDENTITY

	Number	Percentage
Boys	452	91.7
Girls	558	92.7
Total	1010	92.2

CHAPTER XI

The Relation of Interest to Ability, an Intensive Study of the Pupils Making Clerical Choices

Do pupils who adhere to a certain vocational choice tend to have capacities that will give them success in that vocation? This is a very large question and must receive extensive investigation before it is solved. An answer to this question is here sought in just one vocational group and the criterion of success is necessarily of uncertain value. Of the fourteen vocational groups, the clerical one was found to be consistently much larger than any other. Not only this, but the I. E. R. Clerical test, supposedly capable of predicting clerical capacity to an appreciable extent, had been given to the pupils. These two reasons brought about the selection of the clerical group for special duty. There were two hundred sixty-three pupils—two hundred thirty-seven girls and twenty-six boys—who made clerical choices in the beginning and still held to them in October, 1923. The pupils in three large schools were finally selected for special study. When the necessary deductions, due to withdrawals, incomplete records, etc., were made, the number of pupils in these three schools who persistently made clerical choices was found to be one hundred thirty-five—one hundred twenty-four girls and eleven boys. This number is large enough to be representative of the whole clerical group.

Although differentiation in studies commences half a year earlier, these pupils get their first real commercial work at the beginning of Grade 8B. Their class marks[1] in their commercial subjects—typewriting, bookkeeping, and commercial arithmetic—are here considered as a measure of their probable success in commercial work. The scores made in the I. E. R. Clerical test are used in order that its predictive value may be studied. Their average intelligence quotients (the average, for each pupil, of the I. Q. received

[1] The passing mark in these schools is "60."

in the Illinois test and that in the Mentimeter test) and the mental age, expressed in months, were also used. Each of a pupil's three commercial teachers assigned him an effort mark upon a scale ranging from one to ten. The subject-matter marks and the effort marks were secured for the first and second quarters of the eighth grade separately.

The one hundred thirty-five pupils had an average I. E. R. Clerical test score of 47.5. This may be compared with the score of a larger unselected group, of which these pupils were a part, previously calculated in connection with a preliminary study; they, a group of six hundred thirty-five pupils, had an average score of 37.5. The average intelligence quotient of the one hundred thirty-five pupils was 99.3; that of the entire group (of which these six hundred thirty-five constitute a representative sample) was approximately 105. That is, while these pupils whose interest in a clerical vocation had remained permanent averaged somewhat below the large, unselected group in general intelligence, they were markedly superior to them in clerical ability as measured by the I. E. R. Clerical test.

Toops has no adequate norms for Grade 7B pupils with which these results may be compared. However, for eight hundred fifty-one Grade 8B boys, he found an average of 43.5 and for one thousand forty-six Grade 8B girls, an average of 42.5. Therefore, it seems that our specially interested pupils are definitely superior to unselected pupils a year further on in school than they. Interest is, undoubtedly, a potent factor here.

The three effort marks for each quarter were averaged in order to increase the reliability. A corresponding average subject-matter mark for each quarter was found by averaging the marks made in each of the three commercial subjects. For the first quarter the following figures show the averages of the group:

	Arithmetic mean	S. D.
Typewriting	70.0	10.3
Bookkeeping	75.5	10.5
Commercial arithmetic	72.3	16.6
Average mark	72.4	9.4

The following figures are for the second quarter:

	Arithmetic mean	S. D.
Typewriting	74.3	10.0
Bookkeeping	75.7	11.1
Commercial arithmetic	72.1	13.2
Average mark	73.7	7.8

These figures show that the distributions for the two quarters are very similar, with the averages becoming slightly higher and the variabilities becoming more markedly less.

When results for the second quarter's work came in, it was found that nine more pupils—eight girls and one boy—had withdrawn from the school, leaving a total of one hundred twenty-six pupils for study.

The following table gives the correlations worked for both quarters:

TABLE 27

Correlation between	For first quarter (135 cases)	For second quarter (126 cases)
1. I. E. R. clerical and average mark	.14	.38
2. I. E. R. clerical and typewriting	—.10	.11
3. I. E. R. clerical and bookkeeping	.12	.34
4. I. E. R. clerical and commercial arithmetic	.21	.29
5. Average mark and average I. Q	.33	.29
6. Average mark and mental age	.29	.24
7. I. E. R. clerical and average I. Q	.35	.40
8. I. E. R. clerical and mental age	.36	.33
9. Effort and average mark	.62	.68
10. Effort and average I. Q	.30	.23
11. Effort and mental age	.25	.19
12. Effort and I. E. R. clerical	.33	.36

The most striking correlations are those between the clerical test and the school subjects. With average subject mark the r is nearly tripled from the first to the second term, rising from .14 to .38. It is interesting to contrast the correlation of the clerical test with arithmetic with those obtained with the two other subjects. For the first quarter, arithmetic is the only one of the three that is of any significance. It should be noted that the pupils have been working arithmetic for years, while typing and bookkeeping are entirely new to them. Such being the case, we should expect a certain

time to be required for the pupils "to find themselves." And until they should have found themselves, no prognostic test would be likely to correlate closely with their accomplishment. The remarkable increases noted in the second quarter seem to justify this explanation. The *r* with typing gained twenty-one points, rising from a minus quantity; that with bookkeeping gained twenty-two points, and that with arithmetic, eight points. We may at least tentatively conclude that the Toops test tends to show a positive relationship with accomplishment in clerical studies and that this relationship grows closer as time goes on. Further study will be carried on to determine the extent to which this tendency continues.

Effort shows a fair correlation with predicted ability. Effort correlates quite highly (.62 and .68) with the average school mark. In order to evaluate the effort marks given by the teachers, those of the first quarter were correlated with those of the second. A remarkably high correlation of .79 was secured. This assures us that our attempt to measure effort here is, to say the least, highly consistent.

CHAPTER XII

Variations Among the Several Vocational Groups

Is the permanence of a pupil's interest in any way dependent upon the particular vocational group in which that interest falls? We can secure an answer to this question by studying the records of the pupils whose choices originally fell in each group and by determining what percentage of each group adhered to the original choices. The necessary information is given in Table 28.

TABLE 28

Group Percentages of Permanency

Vocational group	Boys			Girls			Total group		
	No. choosing in Dec., 1922	No. remaining permanent	Percentage of permanency	No. choosing in Dec., 1922	No. remaining permanent	Percentage of permanency	No. choosing in Dec., 1922	No. remaining permanent	Percentage of permanency
Agriculture	7	5	71	...	...	..	7	5	71
Manufacturing	3	1	33	...	...	..	3	1	33
Mechanical industries	91	49	54	...	...	..	91	49	54
Transportation	3	1	33	4	2	50	7	3	43
Trade	53	32	60	7	0	0	60	32	53
Public service	6	5	83	...	...	..	6	5	83
Engineers	115	75	65	...	...	..	115	75	65
Physicians	44	31	70	4	0	0	48	31	65
Lawyers and judges	42	30	71	9	3	33	51	33	65
Teachers	3	2	67	195	141	72	198	143	72
Entertainers and artists	16	7	44	54	30	56	70	37	53
Other professions	74	49	66	35	15	43	109	64	59
Domestic and personal	..	...	..	4	2	50	4	2	50
Clerical	34	18	53	286	236	83	320	254	79
No choice	4	0	0	9	1	11	13	1	8
Total	495	305	62	607	430	71	1102	735	67

In the total group the percentages do not vary widely among the groups which attract twenty or more children. The smaller number of cases in the less popular groups renders their percentages practically meaningless. In the case of the boys, permanency is pretty well equalized among the

groups. However, the girls present an entirely different situation. If we except those choosing clerical work and teaching, their average permanence is but 37%. In this connection the following question is in order: What effect has one year had upon the delimitation of the girls' choices? In December, 1922, 50% of the girls made clerical choices and 27% selected teaching, leaving only 23% for all other kinds of activity. In December, 1923, 49% made clerical choices and 33% selected teaching, leaving only 18% for other vocations. That is, as time goes on, girls' vocational choices tend to become more and more restricted. By combining the allied groups, we shall be able to see more clearly permanency variations. Here all six professional groups are united. Agriculture, Manufacturing, and Mechanical Industries are grouped under the last mentioned name. Domestic and Personal Service, Public Service, and Transportation are classed as General Service. Trade and Clerical Services remain as before.

TABLE 29

PERCENTAGES OF PERMANENCY

Vocational groups	Boys			Girls			Total group		
	Total choices	No. remaining permanent	Percentage of permanency	Total choices	No. remaining permanent	Percentage of permanency	Total choices	No. remaining permanent	Percentage of permanency
Professions	294	241	82	297	236	79	591	477	81
Clerical	34	18	53	286	236	83	320	254	79
Trade	53	32	60	7	0	0	60	32	53
Mechanical industries	101	56	55	...	...	..	101	56	55
General service	9	6	67	8	4	50	17	10	59
No choice	4	0	0	9	1	11	13	1	8
Total	495	353	72	607	477	80	1102	830	75

This table indicates that, in three cases out of four, a pupil will adhere, at least for a year, to his type of vocational choice.

We may also study the several groups in respect to the grade of intelligence of the pupils that they attract. For this purpose the groups will be studied in two divisions, those

attracting twenty or more pupils and those drawing less than twenty. The figures are not given separately for the boys and girls here as there is no noticeable sex difference apparent. The median I. Q.'s for the groups of both divisions follow.

TABLE 30

A

INTELLIGENCE LEVELS OF THE LARGER GROUPS

Group	No. of cases	Median I. Q.
Physicians	39	120.2
Lawyers	52	119.0
Engineers	107	113.5
Other professions	122	113.3
Entertainers and artists	62	112.3
Teachers	207	110.2
Trade	49	107.6
Mechanical industries	79	106.1
Clerical	342	100.8
Total	1059	

B

INTELLIGENCE LEVELS OF THE SMALLER GROUPS

Group	No. of cases	Median I. Q.
Agriculture	10	121
Public service	9	116
Domestic and personal	5	114
Manufacturing	1	98
Transportation	7	93.5
No choice	11	109
Total	43	

Part B of this table is given just for completeness. The small number of the cases makes the medians too unreliable to be worthy of any consideration. However, Table A gives results that are, to say the least, interesting. Those children making professional choices are definitely above the other groups mentally. The would-be physicians and lawyers seem to be head and shoulders above the others. Then, we find the three groups—engineers, other professions and entertainers and artists—closely bunched. Two points lower come those who wish to be teachers. Thus, all the groups representing

those who have professional aspirations represent those of intelligence superior to any non-professional group. Next come the future tradesmen and mechanics with I. Q.'s but three or four points below those of the teachers. Finally, after a big gap, those with clerical aspirations bring up the rear. We may conclude that the pupils choosing those vocations that require lengthy and exacting school preparation are those who are most capable mentally.

CHAPTER XIII

The Reliability of the Data Presented

While the essential data of this study were secured through questionnaires, certain factors in the methods employed practically overcome several of the pitfalls which are liable to beset the usual employment of the questionnaire method. For instance, no allowance need be made for any numerical inadequacy of the portion of blanks returned because the original questionnaires were given to all the pupils in the 7B classes who could be reached. Approximately 90% of the gross enrollment was reached by the first questionnaire. The questionnaires were given in a regular school period. The pupils were given all the time they required to fill them out and teacher-examiners were present to explain any terms that the pupils did not understand. Therefore, we may feel reasonably certain that the import of the questionnaire was made clear to the pupils.

Were the pupils competent to answer the questions and careful in so doing? A satisfactory answer can be given to this question. The essential part of the study is, of course, the vocational information secured. The pupil was given an uncontrolled choice in this matter; no vocations were suggested to him. He either had to think or to fail to answer the question. That he chose the former alternative is evident when we remember that 99% of the pupils registered choices. The vital question then becomes: Were these choices actually thought out, or were they a matter of chance? The results obtained from the follow-up questionnaires give a decided answer to this question. After a year, two-thirds of the pupils still cling to their original choices. This percentage (66.7%) may be compared with those obtained from the three sets of controlled choices (Recreational Interests, Study Interests, and Work Interests) studied. These latter gave us permanency percentages ranging between 36% and 40%. Hence, we may reasonably conclude that the pupils are much

more likely to stick to choices to the making of which they must give some thought, than they are to those which are the result of a selection of one out of a number of suggestions. Further, the percentage of permanency of vocational interests for the three periods is practically constant. The laws of chance do not so conduct themselves; were the vocational interests expressed a matter of chance, we should expect a percentage of permanency of from 7 to 10 per cent. Still further evidence may be adduced by comparing the entire vocational distributions of the several periods. The first and second distributions are 91.9% identical; the first and third, 89.5%; and the first and fourth, 90.6%. Therefore, some sort of a law of compensation is at work; while only two-thirds of the individuals retain their original choices, nine-tenths of the group remains constant. If the four distributions are each arranged so as to approximate as nearly as possible the probability distribution, there are no significant changes of position among the vocational groups. For example, clerical work is the most favored group all four times, with a practically constant percentage of the cases. By a chance distribution, it is practically impossible that this could ever happen twice in succession, not to mention four times.

We have seen that the permanency of the vocational choices for one year was 66.7%. The reliability of the instrument (the questionnaire) is only one of the factors involved in the permanency of interests. The questionnaire is just as reliable when it shows a change where a change has actually taken place, as where it shows true permanence. Examination of the questionnaires of the pupils who change has led to the conclusion that a large number of the pupils who changed did so for good reasons. Some of the reasons were: new interests developed through studies and out-of-school activities, weaknesses revealed through school failures, and altered financial circumstances. Hence, if we may express numerically the reliability of the data here secured by the questionnaire, it is decidedly higher than 66.7%.

Are the interests revealed by the questionnaire vital, practical ones? The best answer we may now secure for this question must be based upon our study of the courses which the pupils selected. The choice of a course, as stated previously, represents the most significant decision that a pupil is called upon to make during his junior high school career. The figures speak for themselves; more than 92% of the pupils selected that course which best fits their interests. These interests undoubtedly function in the every-day life of the pupils.

There is one more question to consider: Can these interests serve as a guide to capacity? To secure evidence on this point the clerical pupils were selected both because they constituted the largest sub-group and because more data were available in their case than in that of any other group. It was demonstrated that those who displayed permanent clerical preferences markedly excelled the entire group in a test that purports to measure clerical ability. It was also shown that while their general intelligence was slightly inferior to that of the entire group, they achieved satisfactorily high marks in their three commercial school subjects. This problem requires much more extensive treatment, but the evidence so far produced indicates a positive relationship between interest and capacity.

CHAPTER XIV

Conclusions

1. Intelligence ratings form an effective basis for grouping pupils so that their vocational preferences may be investigated from the viewpoint of vocational guidance.

2. Vocational guidance, to be effective, must be commenced at the beginning of the junior high school period.

3. The vocational interests of junior high school pupils show a very high degree of permanence over a period of at least one year—and that a critical one. Two children out of every three have the same preference at the end of the period as they had at the beginning.

4. Vocational interests are more subject to change while the children are in school than while they are on vacation.

5. The girls' choices are more permanent than the boys'. This difference is due to the greater restriction of occupational opportunities for girls. However, as time goes on, the margin of difference is steadily decreased.

6. Permanency is markedly higher when the choice is uncontrolled than when it is controlled.

7. The gross distribution of vocational choices among the several occupational groups is practically constant for the four periods studied.

8. In the junior high school, economic pressure is evidently not nearly so important a cause of pupil elimination as has been generally claimed. Two other factors—intelligence and interest—must be considered prepotent. The children whose mental capacity is below the average furnish twice as large a percentage of withdrawals as they should do if intelligence were a negligible factor. Children with non-professional interests are more than twice as likely to be eliminated as are those with professional interests.

9. The vocational interests expressed by the pupils are vital and practical. They function almost perfectly in en-

abling the pupils to make the most important decision of their junior high school careers—the selection of their courses.

10. The special study of the clerical pupils shows that the interests expressed are closely correlated with successful school work.

11. The pupils who adhere to clerical interests make much higher scores on a prognostic clerical test than the larger, unselected group, of which they are a part, although they are of lower general ability than the larger group.

12. The relationship between the results secured from the I. E. R. Clerical test and success in clerical studies seems to grow closer as the pupils get further along in their studies.

13. Degree of intelligence and degree of permanency are apparently unrelated.

14. The pupils who wish to enter vocations that require a more or less lengthy and rigorous educational preparation have higher intelligence than those who decide otherwise.

15. Among the girls the following relationships obtain: The lower the intelligence, the more likely one is to select clerical work; the higher the intelligence, the more likely one is to select teaching; and, the higher the intelligence, the more likely one is to choose some vocation other than these two.

16. The occupational field open to the average girl is much narrower than that open to the average boy. The girl's interests are also much more restricted. These facts must be taken into consideration in administering vocational guidance and vocational education. Our aim in vocational education should be to recognize the differences between boys and girls in interests and attitudes by dealing with them in different ways for the purpose of preserving such differences and fostering them. Vocational information courses for girls should be separate from those for boys. The two problems are entirely different. If the distribution of girls' choices were to be superimposed upon that of boys' choices, the percentage of identity would be but 20%; that is, the interests of but one boy in five would be adequately considered in a

course designed to meet the needs and interests of girls, and vice versa. A compromise would not solve the problem; the disparity is too great. A recognition of sex differences in respect to interests and opportunities must be the basis for the organization of effective vocational information courses and for guidance arising therefrom.

APPENDIX I

Vocational Interests Questionnaire

Name ..... Boy or Girl ..... Date.....
Last First
School ..... Class ..... Teacher .....
Age ..... yrs. ..... mos. Father's Occupation .....
What school were you in a year ago, that is, December, 1922?
Ans. .....
What grade were you in then? *Ans.* .....
What was the number of your class? *Ans.* .....

I. Underscore the Course You are Taking.
Industrial Academic Commercial

II. Vocational Preference.
Question 1. What one occupation would you most of all like to go into, when you leave school?
Ans. .....
Question 2. Why do you want to go into this line of work? Give your main reason.
Ans. .....

III. Recreational Interests.
Question 1. Which of the following kinds of entertainment would you prefer to attend? (Mark "1" on the line before your first choice, "2" before your second, and "3" before your third.)
—— Automobile Show.
—— Band Concert.
—— Boat Race.
—— Boxing Match.
—— Circus.
—— Dog Show.
—— Football Game.
—— Grand Opera.
—— Illustrated Lecture.
—— Moving Picture Exhibit.
—— Political Rally.
—— Musical Comedy.

IV. School Subjects I Like Best.
Question 1. Which of the following school subjects have most interested you? (Mark "1" on the line before the most interesting subject, "2" before the next and "3" before the third most interesting.)
—— English.
—— Arithmetic.
—— Geography.
—— History.
—— Science.
—— Penmanship.
—— Manual Training.
—— Mechanical Drawing.
—— Sewing.
—— Cookery.
—— Drawing.
—— Music.
—— Physical Training.

V. Work Interests.

Read through the following list of *kinds of activities* carefully. Select the three kinds of work at which you think you would do best, and at which you think you would be contented to work permanently. Place the figure "1" before that group which you would place first for yourself; place "2" before your second choice; and "3" before your third choice.

Kinds of Activities

—— Growing plants, as in farming, etc.
—— Care of animals, as in stock raising, etc.
—— Operating engines, as locomotives, etc.
—— Operating machines, as in manufacturing, etc.
—— Installing equipment, as electrician, etc.
—— Construction work, as in building, etc.
—— Delicate muscular movements, as dentist, etc.
—— Discovering and repairing defects, as jeweler, etc.
—— Transporting activities, as railroad operation, etc.
—— Meeting and directing people, as secretary, etc.
—— Teaching, as in school, shop, etc.
—— Welfare work, as in social settlements, etc.
—— Advisory service, as physician, lawyer, etc.
—— Organizing people, as in societies, work gangs, etc.
—— Influencing people directly, selling, preaching, etc.
—— Influencing people indirectly, as newspaper work, etc.
—— Organized planning, as in business, etc.
—— Scientific work, as in laboratories, etc.
—— Recording and systematizing records, as in office work, etc.
—— Entertaining people, as musician, actor, etc.
—— Artistic skill, as in decorating, millinery, etc.
—— Artistic creation, as in writing, designing, etc.
—— Field of activity not in this list and described as follows:

APPENDIX II

Selected Bibliography

Note.—The titles included in this bibliography are those of the books and articles that have been of direct value in the present study. For further material on vocational guidance, the three following bibliographies are recommended:

1. Brewer, John M., and Kelly, Roy W.....1917
   A Selected Critical Bibliography of Vocational Guidance. Harvard.
2. Federal Board for Vocational Education.....1921
   Bibliography on Vocational Guidance. Bulletin No. 66.
3. National Society for the Study of Education.....1924
   Twenty-third Yearbook, Part 2, pp. 191-198. Selected Bibliography of Educational and Vocational Guidance. Bloomington, Illinois, Public School Publishing Company.

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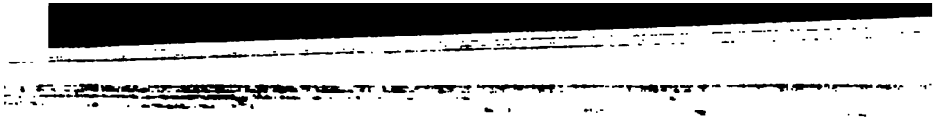
1. Arnold, Felix 1910
   Attention and Interest. New York, The Macmillan Company.
2. Bennett, G. Vernon.....1919
   The Junior High School. Baltimore, Warwick and York, Inc.
3. Bloomfield, Meyer (Editor).....1915
   Readings in Vocational Guidance. Boston, Ginn and Company.
4. Bridges, J., and Dollinger, V.....1920
   The Correlation Between Interests and Abilities in College Courses. Psychological Review, Vol. 27, pp. 308-314.
5. Cratborne, A. R.....1920
   Change of Mind Between High School and College as to Life Work. School and Society, Vol. 11, pp. 28-30.
6. De Garmo, Charles.....1908
   Interest and Education. New York, The Macmillan Company.
7. Dewey, John 1913
   Interest and Effort in Education. Cambridge, Houghton, Mifflin Company.
8. Dewey, John 1921
   Democracy and Education. New York, The Macmillan Company.
9. Duggan, Stephen 1916
   History of Education. New York, D. Appleton Company.
10. Herbart, Johann (Translated by H. M. and E. Felkin)....1893
    Science of Education. Boston, D. C. Heath and Company.
11. Kitson, H. P.....1916
    Interest in Vocational Guidance. Educational Review, Vol. 52, pp. 349-356.

12. Kitson, H. P. 1920
Economic Implications in the Psychological Doctrine of Interest. Journal of Political Economy, Vol. 28, pp. 332-338.
13. McCall, William 1922
How to Measure. New York, The Macmillan Company.
14. McCracken, T. C., and Lamb, H. E. 1923
Occupational Information in the Elementary School. Cambridge, Houghton, Mifflin Company.
15. Miner, J. B. 1922
An Aid to the Analysis of Vocational Interests. Journal of Educational Research, Vol. 5, pp. 311-323.
16. Monroe, Paul 1908
Textbook in the History of Education. New York, The Macmillan Company.
17. Proctor, William Martin 1923
Psychological Tests and Guidance of High School Pupils. Journal of Educational Research. Monograph No. 1. Public School Publishing Co., Bloomington, Ill.
18. Sears, J. B. 1915
Occupations of Fathers and Occupational Choices of 1039 Boys in Grades 7 and 8 of the Oakland Schools. School and Society, Vol. 1, pp. 750-756.
19. Thorndike, Edward L. 1907
The Elimination of Pupils from School. Department of the Interior, Bureau of Education. Bulletin No. 379, Washington, D. C.
20. Thorndike, E. L. 1912
The Permanence of Interests and their Relation to Abilities. Popular Science Monthly, Vol. 81, p. 449 ff. (See also Vocational Readings, pp. 386-395).
21. Thorndike, E. L. 1917
Early Interests: Their Permanence and Relation to Abilities. School and Society, Vol. 5, pp. 178-179.
22. Thorndike, E. L. 1924
The Disciplinary Values of Studies in the Opinion of Students. Teachers College Record, Vol. 25, pp. 134-143.
23. Toops, H. A. 1923
Tests for Vocational Guidance of Children Thirteen to Sixteen. (Teachers College Contributions to Education, No. 136.) New York, Teachers College, Columbia University.
24. Van Denburg, J. K. 1911
Causes of the Elimination of Students in Public Secondary Schools of New York City (Teachers College Contributions to Education, No. 47). New York, Teachers College, Columbia University.
25. Watson, John S. 1891
Quintilian's Institutes of Oratory (2 vols.). London, George Bell and Son.



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EDWARD EARLE FRANKLIN, Ph. D.

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No. 6. "The Measurement of Achievement in Shorthand" (118 pages, 2 folders, $1.50), by Dr. Elmer Rhodes Hoke, Professor of Education, Lebanon Valley College.

No. 7. "The Improvement of Speed and Accuracy in Typewriting" (42 pages, 75 cents), by Dr. Roy Edward Hoke, Professor of Education, Birmingham-Southern College.

No. 8. "The Permanence of the Vocational Interests of Junior High School Pupils" (72 pages, $1.15), by Dr. Edward Earle Franklin, Associate Professor of Education, Birmingham-Southern College.

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